

**CONTRIBUTIONS FROM THE
UNIVERSITY OF MICHIGAN
HERBARIUM**

VOLUME 23

**UNIVERSITY OF MICHIGAN HERBARIUM
ANN ARBOR, MICHIGAN
2 JULY 2001**



Eric Hultén, 1962

JENNIE VAN AKKEREN DIETERLE

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JENNIE DIETERLE AND THE UNIVERSITY OF MICHIGAN HERBARIUM, A FELICITOUS PARTNERSHIP

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Jennie Van Akkeren Dieterle died on July 7, 1999, less than a month before her 90th birthday. Her lifelong interest in plants included a professional botanical career that spanned more than a quarter of a century, until after she was partly incapacitated by a stroke in 1973. Of Dutch ancestry, she was born in Dunkirk, N.Y., on August 2, 1909, and lived in Ann Arbor after 1921, when her father was first employed as a gardener at the University of Michigan Botanical Garden. She was educated in the Ann Arbor schools and the University of Michigan, from which latter she received a B.S. in Botany (1931) and an M.A. in Botany (1935). She married David H. Drummond August 11, 1928, and was divorced January 31, 1935, after which she married Robert R. Dieterle in 1937. She worked as an undergraduate assistant in the Department of Botany (1928–1931), and as an assistant in the University of Michigan Herbarium (1931–1935). During the summer of 1929 she travelled with her then husband to the Rocky Mountains in Colorado and Wyoming, where she did not neglect her botany. On August 7th she wrote to Mrs. Frieda Cobb Blanchard, inclosing a short list of plants that “we dug” (evidently with the University of Michigan garden in mind) in the vicinity of the University of Wyoming’s summer camp in the Medicine Bow Mountains.

After 1937, for the next two decades, she was involved heavily in family responsibilities, until after 1950 she found more time to devote to botany. During the summers, from 1953 to 1957 she collected herbarium specimens industriously in Grand Traverse County, Michigan (about 1000 numbers in all), and visited the University Herbarium for help with their identification and labeling, especially after the Michigan Flora Project was launched in 1956. In June 1957 she returned to work again at the Herbarium, this time in a professional capacity.

Always an enthusiastic gardener and a lover of plants in general, Jennie found a congenial outlet in the University community in Ann Arbor, where there was a long tradition of interest in things botanical. Her own botanical work eventually became so closely tied to the developing herbarium of the University of Michigan that one cannot evaluate her career, nor her contribution to science, without at the same time following the progress made at the Herbarium, especially in the critical period that followed the end of World War II. The collaboration proved to be mutually beneficial. Her contribution to the Herbarium, through her loyalty, her administrative abilities, her broad knowledge of plants, and her attention to detail, did much to clear the way for institutional progress. At the same time the Herbarium provided the support, and the access to professional plant systematics, that she needed to expedite her entry into the field and her recognition as an established systematist.

The Michigan herbarium, although it contained many specimens dating back to 1837 (the year in which Michigan became a State), began its modern existence in 1912, when Calvin Henry Kauffman was named Curator of the Cryptogamic Herbarium, and Henry Allan Gleason Curator of the Phanerogamic Herbarium. Both were members of the Botany Department, which housed the herbarium. In 1915 the Department moved to the newly erected Natural Science Building, where each of the two herbaria occupied one room. In 1916 or 1917 John Henry Ehlers succeeded Gleason. In 1921 the several plant-collections, including a large series held by the Museum of Zoology, were united into the Herbarium of the University of Michigan, with a budget separate from that of the Department of Botany, with Kauffman as Director and Curator of Cryptogams, and Ehlers continuing as Curator of Phanerogams. In 1928 the herbarium was moved to the newly opened University Museums Building, where it was housed in solidly built and handsome birch-wood cabinets (which alas were not insect-proof). It occupied a part of one wing of the fourth floor of the building.

All the divisions of the united herbarium grew steadily larger during the first part of the 20th century, but at first without much direction. After 1915 the Herbarium (and especially the collections of vascular plants) began to receive quantities of specimens from Harley Harris Bartlett, who joined the staff of the Botany Department in 1915, became a full-time member of the department (but not a member of the Herbarium staff) in 1916, was promoted to Professor in 1921, became Director of the University Botanical Garden in 1919, and Chairman of the Botany Department in 1923. Because Jennie's family lived on the grounds of the Botanical Garden where her father worked, she became acquainted with Professor Bartlett while she was still a child, and became one of his unofficial "nieces" who called him "Uncle Harley" (as I did in later years, but of course not in the university setting).

Ehlers reported to Kauffman in 1921 that the "Phanerogamic" collection had been increased considerably by the gift of Bartlett's personal herbarium: "Of the recent accessions that of H. H. Bartlett is by far the most valuable not only in the number of specimens, but in the quality and worth of the specimens themselves. Some of them are rare and hard to duplicate. It is here suggested that some recognition of this gift be made by the Board of Regents."

Continued collecting activity, and resultant accessions of botanical specimens, crowded the Herbarium's quarters beyond capacity. In the years that followed, the problem intensified. The number of unprocessed specimens on hand continued to outgrow the available space, and by the time of the onset of World War II the need for such space, and the need for the labor to handle the specimens, had become critical.

After 1928, under Kauffman's influence, the activities of the Herbarium as a whole began to be oriented toward mycology (fungi were then routinely treated as plants), and toward the study of other non-vascular plants. The first three directors, Kauffman (served 1921–1930), Edwin B. Mains (acting Director, 1930; Director 1931–1959), and Alexander H. Smith (Director 1959–1972) were mycologists of note. The principal staff of the Herbarium until 1926, as listed on the letterhead, consisted of Kauffman and Ehlers. There were four "assistants" whose duties included mounting, labelling, and cataloguing specimens. In 1927 Bessie B. Kanouse (a mycologist) was listed as Curator of Cryptogamic Collections. The next year she received the added title of Assistant to the Director.

In his 1930–31 report to President Alexander Ruthven, Dr. Mains noted that the entire [Bruce] Fink lichen collection had been renovated by Miss Joyce Hedrick and Mrs. Jennie Drummond. On June 15, 1932, Mains was notified that the Herbarium budget included an item for 12 months' support of Jennie V. Drummond, as Recording Assistant. This appointment was reduced to three-fourths time in 1934–35 and 1935–36. In his 1932–33 report, Mains noted that "The moss herbarium has been accessioned by Mrs. Drummond and all the identified specimens have been entered and distributed." It was evidently in her capacity as Recording Assistant that she signed, as Jennie V. A. Drummond, reports on the University Herbarium Library, as of June 1, 1933, June 1, 1934, and June 1, 1935.

In his 1933–34 report Mains described in detail the very important gift of the "mounted collection of approximately 35,000 specimens" comprising the herbarium of Parke, Davis & Co. He concluded: "Due to the fact that the Herbarium has been stored at the factory it was necessary to clean the mounted material before it could be included in the University collections. This has been nearly accomplished by help from the C.W.A. and F.E.R.A. projects. Mrs. Drummond and Mrs. Steidtmann have made a card file of all the mounted specimens and have arranged these by collector and region."

With respect to the bryophyte collection, in her report to Mains, 1933–34, Bessie Kanouse had said, "The duplicate moss collection which was a very confused assortment of good material, was entirely reworked by Jennie V. A. Drummond into an orderly unit. All the specimens were packeted ready for distribution with proper labels and arranged by localities so that they are at once accessible. A careful check was made against the herbarium to make sure that no collection was omitted from our herbarium. There are 1300 packets ready to be used in exchange."

Between 1935 (the year of Jennie's divorce) and 1957, she disappears from the Herbarium records. During this time she accepted a position as a secretary at the University of Michigan Psychopathic Hospital, where she met one of the attending physicians, Robert R. Dieterle, whom she married in 1937. She became the mother of two children, and for almost 15 years her botanical activities were confined to gardens, a home greenhouse, and informal botanizing in the woods and fields of the farm outside Ann Arbor where they lived.

By 1936 the Herbarium staff had reached approximately the composition it maintained for another decade. The total budget for 1936–37 included \$7276 in salaries and \$2247 for current expenses and equipment. (Professor Mains received no salary from the Herbarium.) The staff in addition to Mains included Bessie B. Kanouse (Assistant to Director and Curator), A. H. Smith and C. L. Lundell (Assistant Curators), Amelia A. Lundell (Recording Assistant), Joyce H[edrick] Jones (Research Assistant), and W. C. Steere (Research Associate [without salary]). In the year 1941–42, for the first time, a fulltime "Technical Assistant" (i.e., a plant mounter), Mrs. Florence W. Schultz, was added to the Herbarium budget.

It must have been during this time that Mrs. Lundell (Amelia A.) began making the thousands of beautifully hand-written labels that appear on so many of the collections made by the Lundells and others, and which have elicited many questions about how it was possible to produce such uniformity and clarity in such profusion. The curator's report on May 1, 1938 shows that "Mrs. Lundell, on part time employment, supervised the WPA and NYA work, wrote and entered 7000 genus covers, distributed 10183 specimens in the herbarium, labeled approximately

9000 specimens, completed boxing and labeling of the fruit collection, and handled incidental typing" [presumably in her spare time!].

The need for more space in the herbarium (for proper handling and shelf-space for specimens), was an ever-present and always increasing problem, which the curators, through Dr. Mains as director, repeatedly brought to the attention of the University administration. In the Museums Building all the existing space had been utilized almost from the beginning. In her 1936–37 report, Kanouse wrote that after some planned rearrangements, they had space "to accommodate nearly all the collections within cases." With such active (and interactive) persons as A. H. Smith, C. L. Lundell, and W. C. Steere on the staff, growth was especially rapid in the collections of fungi, vascular plants, and bryophytes. In the 1937–38 report Steere wrote, "At the end of this year we find ourselves in the perennial plight of having all space filled and many boxes of specimens yet to be distributed into the Herbarium. It is hoped, consequently, that some more case room may be available at the beginning of the next year," and Lundell reported as of May 1, 1938, that "Approximately 20,000 mounted specimens are on hand in the unorganized collection. Serious shortage of cases prevents distribution of this material, mostly valuable Tropical American collections. A start was made toward sealing in boxes the large unmounted, unorganized collection so that it can be stored without danger of insect destruction. An estimated 80000 unmounted specimens are on hand, about two thirds of which are Far Eastern."

The following year Lundell reported increasing difficulties, concluding "The continued accumulation of collections, without facilities for handling them, is reaching a critical point."

After my first year at Michigan I reported to Director Mains as follows, on July 28, 1947: "It is still possible to make some additions [to the herbarium], but I estimate that to accommodate the undistributed material now on hand, and to allow some space for rearrangement and additions, not less than 75 additional steel cases are needed urgently and at once."

In his report for 1948–49, Mains said, "The acquisition of 40 herbarium cases has made possible distribution of some of the stored material into the classified collections, . . . the total number available for consultation being 414,137." As of June 30, 1949, I reported to Mains, that in spite of the 30 new cases allotted to the phanerogamic collection, I still estimated that at least 75 new cases were needed to accommodate material already on hand, and the 10,000 to 12,000 specimens that were being mounted annually.

In the next few years some effort was made to solve this problem. In my report to the Director for 1950–51, I commented: "It will be noted that we are gradually reducing the amount of material which has been stored since the days of Dr. Ehlers without any system of recording. Such material is essentially lost when the person who received it dies or leaves the University, and we have been making an effort to examine all this stored material and record it properly, subsequently filing it with the rest of the unmounted accessions. During the past year approximately 2500 specimens were taken from the 'lost' category and recorded, and it is hoped that the work can be completed this coming year."

A similarly optimistic comment appeared in my report the following year: "We are still reducing the amount of material which has been stored without record. This year a total of 2900 specimens, or about one-fifth of all the accessions, came from this source. We are still hopeful of completing this work, but some specimens remain in the 'lost' category."

It transpired that all such optimistic estimates had been made without considering the relatively enormous amount of material that had been amassed by Harley Harris Bartlett, most of which had never been turned over to the Herbarium, but remained in Bartlett's custody in various stages of preparation. Although Bartlett was never a member of the Herbarium staff, he felt keenly the need of supporting it as the principal repository at the University. He and Director Mains were very different in their attitudes toward the collections. As best I can express it, Mains felt it a primary responsibility to protect the specimens already in his care, and make them available to all qualified students. Adding to the existing collections was a secondary consideration.

It was clear to Bartlett, on the other hand, that more and more collections, from as many different parts of the world as possible, were urgently needed in herbaria to provide students (at all levels) with adequate samples. His philosophy seems to have been a simple one—go ahead and acquire the specimens, by persuasion, personal activity in the field, or purchase and exchange, and then put enough pressure on the University administration to convince them of the need for more space. He himself was an indefatigable collector, whose numerous specimens, as well as those of other collectors whom he encouraged or supported via the Botany Department or the Botanical Gardens, were donated to the Herbarium, and contributed not only to the size of the collection as a whole, but markedly to its quality. Many were from the Old World, e.g., as reported by the curator in June 1931, 681 collections from Indo China, gathered by J. & M. S. Clemens, and 1200 specimens from "Punjab, India" as a gift from the Botanical Garden. At the same time, however, the curator noted the receipt of two series from Mexico ("Pringle collection thru Bot. Garden, 619"; and "Pringle Collection thru Mr Bartlett, 676"). Appended to this report of June 1, 1931, was a note, "Three boxes of Professor Bartlett's plants have been received and twenty more are expected daily."

In his report for 1934–35, Mains wrote: "During the past year 6,820 Asiatic specimens have been received largely due to the interest of Professor Bartlett in the botany of the Far East. It is estimated that with those received in previous years, the Herbarium now has an accumulation of 12,000 Asiatic specimens and 6,000 duplicates. Most of these have not been mounted and have been stored in bundles.... It is obvious that the present facilities of the Herbarium are not sufficient to make the accumulated Asiatic material available for consultation in the near future. If studies of the botany of the Far East are to be continued, provisions should be made for increased facilities involving additional floor space, herbarium cases, assistance and increased funds for supplies."

It was inevitable that long before I came to the Herbarium in 1946 as Curator of Phanerogams (later Vascular Plants), Bartlett's collections had far outstripped the ability of the Herbarium to care for them properly, or even to accept them as gifts. His collections continued to grow. He worked on them himself as his time permitted, in his offices at the Department of Botany or at the Botanical Garden. He found friends, students, and others who worked by the hour, assisting him with the preparation of labels, sorting, packaging, shipping, and storing. As the collections continued to expand, he found additional quarters in other University buildings, which he eventually filled to capacity. It was his intention to process one complete set of the specimens for the University Herbarium, and segregate the duplicates (often many sets), after labelling, for future exchange. Only his advancing age, ill health, and eventual death stood in the way of this. He retired

officially in 1956 and began to talk with Mains, and with me and others, about the eventual disposition of his collections. It was not long before some action was taken.

The following is from my report to the Director of the Herbarium, for 1956–57: “In 1956 the Regents approved a grant of \$20,000 to organize and study the collection of approximately 150,000 Asiatic plant-specimens which had been accumulated over a period of some 30 years [sic] by the University Botanical Gardens, and personally by Professor H. H. Bartlett. The collections had been (and are) housed in ten rooms in the Special Projects Building [a building in the University Hospital area, formerly used as a maternity hospital – RMcV], where they occupy approximately 2000 square feet of space. It was thought that the unique value of many of these collections and the careless manner in which they had been stored, made it necessary for the University to take prompt action to safeguard them from dust, fire, insect damage, and breakage. The work of organization was put in charge of a faculty committee of which I was named chairman.”

The committee at once took steps to implement this decision. Su-Ying Liu, a former doctoral student of Bartlett's, began work on a full-time basis on September 1, 1956, and she was joined on April 15, 1957, by Annetta Carter, who took leave from her position at the University of California (Berkeley) in order to help us. Miss Carter was at that time, without any doubt, the most knowledgeable and able person in the country, if not in the world, with respect to herbarium practices, and it was she who planned, supervised, and took part in the initial steps that eventually brought the University of Michigan Herbarium from a rather large but disorganized and unfocused collection to the renowned and superbly managed herbarium that it is today. In all she spent 13 months in Ann Arbor (April 15–October 15, 1957, and July 1, 1958, through January, 1959).

Jennie Dieterle returned to the Herbarium staff in June, 1957, officially as a Technical Assistant, in practical terms as a plant mounter. Since 1953 she had been making summer collections of the flora of Grand Traverse County (an activity she preferred over fishing while the family vacationed), and reacquainting herself with the Herbarium, its progress and its personnel. As the result of her efforts, 790 new specimens from Michigan were added to the University Herbarium between 1953 and 1957, and more than a thousand duplicate or superfluous specimens from the same area were sent in exchange, including 627 to the Swedish Museum of Natural History (S), and 395 to the Carnegie Museum, Pittsburgh (CM).

From October to June (1956–57), as noted in a report by E. G. Voss, Jennie worked as a volunteer one afternoon each week, identifying specimens from recent collections in Michigan, typing and pasting labels, and helping generally with the Michigan Flora Project. The following year she continued in the same position, mounting or repairing a total of 2757 specimens from Michigan, and spent a total of 54 days helping Annetta Carter with the “Asiatic Plant Project” on matters not directly related to mounting specimens. During and after Carter's second visit (1958–1959), Jennie took an increasingly large part of the responsibility for the final labelling and sorting of the Asiatic specimens, the selection of the principal set for the Michigan herbarium, and the segregation, packing, shipping, and recording of the many duplicate sets. The Curator's report for 1958–1959 enumerates her major assignments:

1. The boxing (as a protection against insect damage) of about 40,000 newly accessioned specimens, and about 150 cartons of unstudied specimens.



Jennie Dieterle in a herbarium setting, perhaps before 1960, when she was working with Annetta Carter.

2. Preparation for study of certain large collections from Iran and South America, including transferring the notes from the collectors' field records and preparing formal labels for distribution, and the segregation of duplicates.
3. Preparation, packing, and shipping, as a long-term loan to Cornell University, an entire truck-load (about 150 cartons) of Mr. Bartlett's unidentified palm-specimens, mainly from the Far East.
4. Segregation, labelling, and arrangement of the approximately 90 cartons (or an estimated 15,000 numbered wood-specimens) that had been collected in connection with Prof. Bartlett's identifiable herbarium material, but more recently had been found in storage, in confusion with unrelated materials.
5. Final handling of the remainder of large collections. Studying and evaluating of all small bundles, packages, and remnants found among the *Reliquiae Bartlettianae*, and discarding what seemed to be valueless.

Thus Jennie Dieterle, already experienced in herbarium ways, and a veteran plant-mounter, was forced by circumstances to learn every detail of the operation and maintenance of a large herbarium. This began during her association with Annetta Carter in the Asiatic Plant Project, and the subsequent extensive packing and general housekeeping in preparation for an anticipated move of the Herbarium to new quarters, and continued as her responsibilities grew during the period of unpacking and relocating after the move in 1960. The move came about more or less as follows:

Fortuitously, at about the time of Bartlett's official retirement in 1956, the University found it necessary to move its general stores and stockroom, and its machine shop and carpenter shop, into much expanded quarters, and to vacate the very substantial brick building (later named North University Building), across the street from the Museums Building that at that time housed the principal University Herbarium.

In mid-1958, Associate Dean of the College Burton D. Thuma expressed a wish to see the quarters in which the various herbarium holdings were currently housed. The then Chairman of Botany Kenneth L. Jones, Dean Thuma, and I visited the nearby Museums Annex (adjacent to North Hall, the present ROTC building), the Herbarium proper (in the Museums Building), the recently acquired Cope-land Fern Herbarium of some 25,000 specimens (in the Natural Science Building), and the Special Projects Research Building (the former maternity hospital in which most of Mr. Bartlett's accumulations had been stored, and where Annetta Carter and Jennie Dieterle had done most of the work of renovation, in what they called "The Wards").

Dean Thuma then suggested that the Herbarium would fit nicely, with room to spare, into the soon-to-be-vacated carpenter shop, which could easily be turned into a cavernous room with many windows and no partitions. At his instigation a meeting to discuss herbarium needs was attended by Dean Thuma, Mr. John McKevitt (representing Vice President Pierpont), Mr. Robert Aitken (representing the University architect), and members of the staff of the Herbarium. With support from Mr. McKevitt and the University architects, plans were drawn up, and a request for an appropriation of \$135,000 was submitted to the Regents at the meeting in June, 1959. Preliminary layout for the new space was approved on July 13, bids for construction were opened on October 20, and the work was completed in time to permit us to move all the herbarium materials into the new space before midyear, 1960.

After the move we were faced with the problem of rearranging great mountains of cartons packed with herbarium specimens and relocating them efficiently with an eye to future expansion. With the aid of a grant from the National Science Foundation, we were able to hire three new plant-mounters for a period of five years and to purchase 400 new steel herbarium cases (of which 265 were assigned to the collection of vascular plants). We were also able to use part of the funds to persuade Dr. Ralph R. Stewart, an authority on the plants of West Pakistan and the northwestern Himalaya generally, to relocate in Ann Arbor after his retirement from Gordon College in Rawalpindi, and work on the organization, final labeling, and identification of the Koelz-Rup Chand collections from Persia and India. In 1959 we estimated that these collections included between 15,000 and 20,000 numbers. All were still stored in sealed boxes in the original newspapers, labelled after a fashion but unidentified.

These activities placed additional responsibilities on Jennie, who responded splendidly. She took a major part in the relocation of the mounted and unmounted collections in the newly available space. She took over the training and incorporation of the new mounters without a hitch, and by the time Dr. Stewart arrived (in October) she had a better knowledge than anyone else of what was in the herbarium and how to find it. For example, she wrote to Annetta Carter on November 8, 1960: "Our regular collections have been out where they can be found and used (with the help of a guide list), so we have been sending loans as usual. When the new cases arrive and we can spread out, it will be possible to distribute the mounted accessions that have had to wait for space to be filed. There are about 40 cartons

of these...the reason we needed a new guide to find things is that, for the sake of a better appearance, all cases were arranged after the moving according to type (we have about six), rather than according to contents. All the families were scrambled unpredictably in the rows of cases, until we have the great shift into the new pigeonholes."

The Curator's report for 1959–60 noted without fanfare that Jennie had been a valuable assistant, that because of her capability she was assigned various projects in addition to the routine work of mounting, and that she was recommended for promotion to Herbarium Botanist, a position that she assumed on July 1 and held until 1972, when she was promoted to Assistant Curator. The Curator's report for 1960–61 was enthusiastic: "The addition of Mrs. Dieterle to the staff has made it possible for us greatly to improve the efficiency of our preparation (mounting) of specimens and in the handling of new accessions, loans, and exchanges. [She] has assumed complete charge of the plant-mounters with a minimum of friction. . . [She] has also [assumed] most of the supervision of the details of accessioning, and the handling of loans and exchanges. My responsibilities in these areas have become chiefly advisory. She is a most valuable addition to the staff, not only because of the work of which she relieves the Curator, but also because of her interest in the problems of the Herbarium as a whole and the thought she gives to them."

As an example of this last, the Curator cited Jennie's first-published botanical paper (*Rhodora* 62: 322. 1960). One of the problems in mounting plant-specimens with glue is to ensure equal pressure on all points of the specimen while the glue is drying. She devised and had made for the herbarium a number of flat cloth bags the length and width of a conventional herbarium sheet, and filled with fine sand to a uniform thickness of about 4 cm. When spread out over a newly glued specimen, the bag adapts to inequalities in thickness and provides the uniform pressure that is needed. Her original bags are still in daily use at the Herbarium.

During the same period (1960), Jennie's botanical activities extended outside the Herbarium as well, in that she was a founding member and one of the first officers (Treasurer) of the Huron Valley Chapter of the Michigan Botanical Club.

The grant that had enabled us to use Dr. Stewart's help with the Asiatic collection also included funds for the support of experts on the floras of other parts of the world. Dr. Eric Hultén, then recently retired as Director of the Botanical Department of the Swedish National Museum, came in February, 1962, and spent a little more than two months in the Herbarium, identifying our previously unstudied Arctic collections, especially those from Alaska, where one of his principal research interests lay.

Hultén's presence in Ann Arbor laid some additional (but reasonably welcome) burdens on Jennie, who not only served as his guide to the collections in the Herbarium, but also as a part-time hostess. Eric was extremely charismatic. He struck up a strong friendship with Robert Dieterle, Jennie's husband, and as a result became a frequent guest at the Dieterle home. He continued to correspond with the family after his return to Sweden, and with Jennie after Robert's death in 1969.

Jennie was also involved with our other visiting expert of the time, Dr. Jerzy Rzedowski, then of the Escuela Politécnica Nacional of Mexico, who came to the Herbarium about April 15, 1962, and worked two months with me on the organization and identification of our large accumulation of Mexican and Central American plants. It may well have been the friendship built up by this association with Rzedowski that induced her to accompany him on a long field trip in Mexico the next year.



Jennie Dieterle on a field excursion at the University of Michigan Biological Station at Douglas Lake, probably in 1962.

During these years she had developed a strong interest in the Mexican flora, no doubt partly because of strong involvement on the part of the Herbarium staff, which from about 1930 on had resulted in large accessions from that country, and increasingly large accumulations of unidentified specimens. As noted above, Jennie was always a lover of plants and of growing plants in the garden, and as the managerial problems in the herbarium lessened with the years, she became more involved in plant-identification in general, and attracted to the formal approaches to systematics in which she saw her fellow curators immersed day after day. After consultation with some other botanists, and some searching of the literature to locate a group of plants that was interesting and was also in need of taxonomic study, she decided rather arbitrarily that she would become an expert on the Cucurbitaceae, the gourd family.

Approaching the age of 50, she undertook to master the technicalities of a large and diverse group of plants that many botanists avoided because of the presumed difficulties in the way. Many common cultivated plants belong to this family, including melons, cucumbers, squashes, pumpkins, luffas, and gourds. The relationships between the many cultivars and the wild species from which they have presumably been derived are complicated and often very obscure. The plants



Jennie Dieterle in Leiden, 1958, with her friends Ding Hou (left) and Su Ying Liu (right). [Photo by courtesy of the Hunt Institute for Botanical Documentation].

are difficult to study from dried specimens because they are mostly climbing or trailing vines that tend to wilt inordinately before they can be pressed. The flowers are unisexual, the two sexes often on different plants. Many of the diagnostic features are in the staminate flowers, which have a very complicated structure. The stamens are often very small and concealed within the tubular corolla. Other diagnostic characters are in the fruits, which are very diverse, and are often not present on specimens with fresh flowers. The fruits may be fleshy and juicy or dry and woody, dehiscent or indehiscent, often very large.

Undeterred, Jennie set out to become an expert on the Cucurbitaceae of Mexico. She corresponded with the current specialists in the family. She sought out and photocopied most of the pertinent literature when she could not obtain the originals. Working with fresh and dried specimens, she made herself familiar with the almost unbelievable complexities of the flowers. She undertook to identify the (mostly unnamed) specimens of cucurbits from Mexico that were piling up in the Michigan herbarium.

In the course of her study, she undertook a trip to work in European herbaria. She wrote to Annetta Carter on March 24, 1958, anticipating the latter's second visit to Ann Arbor and her own upcoming trip: "My plane for Europe is scheduled to leave Idlewild for Amsterdam June 21, and will return from London August 30, making my absence about ten weeks long."

She ultimately visited the major herbaria in Leiden (L), Utrecht (U), Paris (P), Munich (M), Geneva (G), and the London area (BM, K).

She later made four prolonged collecting trips to Mexico, always with emphasis on collecting Cucurbitaceae and, except for her 1963 trip, especially for plants of that family.

Annetta Carter had attended the Second Mexican Botanical Congress, held in San Luis Potosí in September, 1963, and wrote to Jennie on the 29th of that month, enthusiastic about the lush vegetation as seen from the air all across

Mexico. Jennie responded on Friday, October 11, ready to leave and eager to go. She was preparing to accompany Jerzy Rzedowski, who was one of the best-known field botanists in Mexico, and Charles Feddema, a graduate student at Michigan, who had collected in Mexico on three previous trips, and who would drive a University of Michigan carryall that could hold all three botanists and their luggage and specimens.

"Charles Feddema left with the truck today. He has all my gear aboard. I'm taking the plane Sunday morning, will stop until Tuesday afternoon in Arkansas...will arrive in Mexico on the flight from New Orleans, about 9:45 p.m."

She had reserved a room at Casa González, the *pensión* in downtown Mexico City where Michigan botanists had stayed for many years, and expected Feddema to join her there on October 17. Her letter continued:

"Not knowing first-hand what to expect, preparing for both heat and the cold of the return trip in December, and being generally green about field trips anyway, it was a real task to choose my clothes and equipment, but I feel fairly confident now that I made a good selection for the space I had to put it in. (We'll see.)"

The trip overall was a success. The three botanists collected independently, each keeping an individual numbered series. Jennie's numbered series included nos. 3000–3251, including many new records for the proposed *Flora Novo-Galiciana*. Under Rzedowski's expert guidance, they travelled widely in Jalisco, Nayarit, and adjoining territory, finding collecting good wherever they went, and reaching some rather remote areas into which collectors had not penetrated. She remembered being told of President Kennedy's death when her group returned to a town and her incredulity at the news. With Feddema, she returned to Ann Arbor in December. For the summary details of this and her other trips to Mexico, abstracted from her fieldbooks, I am indebted to Richard K. Rabeler, Collections Manager at MICH. Her collections in 1963 are summarized below by date and serial-number, and a general locality, i.e., the name of the state (*estado*) in Mexico:

Jalisco: 3000–3070	22 October–1 November
Zacatecas: 3071–3072	1 November
Jalisco: 3073–3080	2 November
Zacatecas: 3081	3 November
Jalisco: 3082–3087	4 November
Jalisco: 3088–3123	11–15 November
Nayarit: 3124–3146	17–19 November
Michoacán: 3147–3181	23–25 November
Guerrero: 3182–3251	30 November–5 December

Having gained some confidence and field-experience, Jennie made three more collecting trips to Mexico, with some Herbarium support but using private funds as well. On August 13, 1969, she wrote to Annetta Carter:

"The main reason for going is collection of Cucurbitaceae, anywhere, but especially in Nueva Galicia. Launching an expedition just now is a difficult matter, travel money being tight, and companions hard to pry loose from previous commitments. However, since I am deeply interested in the family, and want to accomplish as much as possible while I still feel vigorous, I have decided to go anyway, and finance the trip privately. Rog and Alex are completely sympathetic, helping me wherever they can...and Dr. Rzedowski has arranged to loan me a man [F. Ventura A.] from his own herbarium staff to assist with the field work.

"A station wagon in the University car pool will be available September 4. I plan to depart September 6. One of my nieces [Helena Hoseney] who once worked part-time in the Herbarium is riding along to Guadalajara, and then will stay another week. Next, Ann La Riviere, also a former Herbariumite, will fly down from Los Angeles to travel with me another two weeks. Barbara Steinhauser, of our staff here, will fly down for one week of collecting and the ride home. If my money holds out...I'll return home November 1."

"In accordance with the advice of Dr. Rzedowski, we will make headquarters in a series of towns large enough to have a reasonably comfortable motel with adequate electricity to supply the plant driers, and make daily forays into the surrounding areas. The final itinerary will depend on rainfall and local season conditions." The electric plant driers were something of an innovation for Mexico, as in the 1950s neither motels nor dependable power-supplies were widespread enough to satisfy the needs of itinerant field-botanists.

In the end, this trip in 1969 proved to be more ambitious than she had anticipated. After making a few collections along the highway in Nuevo León and San Luis Potosí, she spent about three weeks in Nueva Galicia before continuing into eastern Mexico and northward toward the border, where her last collections were made in Nuevo León on October 20. Her numbered series of collections (consisting primarily of Cucurbitaceae) ranged from 3403 to 3684. She wasted very little time on hastily gathered roadside specimens, but made every possible effort to obtain complete and well-prepared material whenever she stopped.

Nuevo León: 3403–3404	11 September
San Luis Potosí: 3405–3606	12 September
Jalisco: 3407–3529	12–24 September
Colima: 3530–3537	25–26 September
Jalisco: 3538–3542	27 September
Colima: 3543	27 September
Jalisco: 3544–3588	28 September–2 October
Querétaro: 3589–3593	3 October
D.F.: 3594–3596	5 October
Guerrero: 3597–3615	8–9 October
D.F.: 3616–3617	11 October
Morelos: 3618–3623	11 October
D.F.: 3624–3630	12 October
Hidalgo: 3631–3638	14–16 October
Puebla: 3639–3642	16 October
Veracruz: 3643	17 October
San Luis Potosí: 3644–3660	18 October
Tamaulipas: 3661–3674	18–19 October
Nuevo León: 3675–3684	20 October

Between trips to Mexico, Jennie managed to work in miscellaneous identifications of cucurbit specimens, care for her collection of living cucurbits at the University of Michigan Botanical Garden, and visit Harvard University on a trip to further her cucurbitaceous ends. On June 15, 1971, she wrote to Annetta Carter:

"The *Schizocarpum* seeds arrived and I'm sowing them right away.... The other cucurbit fruit you found in the same place is *Echinopepon*. That yielded a couple of seeds also, which I am also planting....

"My visit to Harvard was most worthwhile and enjoyable. I selected what I wished to borrow, was able to name or rename a considerable number of sheets, and saw excellent material of several American genera I had known previously only from published descriptions."

During her Harvard visit, she met or renewed acquaintance with, as she said, "Bill" Gillis, Carroll Wood, Bernice Schubert, Lily Perry, Frank Seymour, the Tryons [Rolla and Alice], [Lorin] Nevling, and [Reed] Rollins.

On September 16, 1971, Jennie reported (as Herbarium Botanist) to Director A. H. Smith, noting that during her visit to the Field Museum, in May of that year, she had been invited by the Curator, Louis O. Williams, to prepare the treatment of Cucurbitaceae for the prestigious *Flora of Guatemala*, most of the final parts of which were written by Williams himself.

"In my time available for research, roughly a quarter, I have continued investigations in the taxonomy of Mexican Cucurbitaceae. I have also visited herbaria at Harvard University, the Field Museum, the Missouri Botanical Garden, Michigan State University, the State University of Iowa, and the Instituto de Biología and the Instituto Politécnico Nacional in Mexico City. At each of these institutions I identified specimens, improved my understanding of genera not well represented in our own herbarium, and selected sheets for borrowing. Loans were also secured from California, Wisconsin, and Texas. Thus far, 455 sheets have been assembled, in addition to our own, for a revision of *Sechiopsis* and *Schizocarpum* and construction of a descriptive-diagnostic key to all the Mexican cucurbit genera.

"Each summer, I have had numerous cucurbit cultures growing at the Botanical Garden and in my private greenhouse. To gain further acquaintance with the living plants, and expand our herbarium collections, I spent seven weeks in Mexico in 1969, and am preparing to go there again this autumn."

She was already planning ahead to her next Mexican excursion, when she wrote to Annetta Carter on May 28, 1971 (after a short trip to Iowa to visit her daughter):

"The first morning I was back on the job, one of the graduate students [James Duffield] asked me whether I was still contemplating going to Mexico this fall, and said he hoped he could go along. He has a grant of money, and a project (*Montanoa*), and had been in every day to see whether I had come home yet. So I "enrolled" him, and it's pretty well settled that we will leave about October 15. Rog thinks I should consult Dr. Rzedowski about a third person, as he might like to include someone from his staff

"Our itinerary, as always, will depend on field conditions, but Jalisco & vicinity will be first choice, then Western Mexico generally. If there is time, we may get into Oaxaca, or even Chiapas. I am anxious to get additional *Schizocarpum* collections, and to track down material for some of the cucurbit puzzlers that may be new genera as well as new species."

As Jennie informed the Director (report of 1971-72), she was in Mexico for about seven weeks, leaving Ann Arbor October 15 and returning December 5. James Duffield, the Herbarium Assistant, accompanied her. William L. Graham, another graduate student, joined the party in Mexico City after Francisco Ventura (who had assisted her in 1969) was unable to meet them.

In a letter to the staff of the Michigan Herbarium (from Melaque, Jalisco, November ?12, 1971) she commented that the party was looking forward to getting back into higher altitudes, saying "the mornings and evenings are pleasant here [on the Pacific coast], but the sun is broiling in the daytime."

"Collecting has been good. I've found many of the special things we came for, so that keeps up our spirits and will to work. Jim and Bill are fine helpers, strong and enthusiastic, and we all manage to live together without getting on each others nerves. I feel very fortunate in having Bill to take the place of Francisco, who was sick when he was supposed to meet Jim and me. Bill knows so much about the country and has many helpful pointers about how to do things, which he learned in his trips with Dr. McVaugh."

In this 1971 trip Jennie tried to visit parts of Mexico that she had not seen previously. From Nuevo León she turned westward through Coahuila and Durango to Sinaloa, thence southward through the lowlands into Nueva Galicia where she spent the next three weeks. After leaving Melaque, Jalisco (see letter quoted above), the party passed on November 13 from the city of Colima to Guadalajara, thence to Guanajuato to investigate a locality where Duffield wanted to search for a certain species of *Montanoa*, and finally via Mexico City to Guerrero and Oaxaca before turning homeward. Her collections during the trip are summarized below:

Nuevo León: 3800–3804	19 October
Coahuila: 3805–3815	20 October
Durango: 3816–3839	21–22 October
Sinaloa: 3840–3869	23–25 October
Nayarit: 3870–3983	25–29 October
Jalisco: 3984–4088	30 October–5 November
Nayarit: 4235–4237	6 November
	[to correct a double number series]
Jalisco: 4238–4242	6 November
	[to correct a double number series]
Jalisco: 4089–4160	7–12 November
Colima: 4161–4176	12–13 November
Jalisco: 4177–4192	13–16 November
Guanajuato: 4193–4196B	17–18 November
México: 4197–4204	20 November
Guerrero: 4205–4206	24 November
Oaxaca: 4207–4228	26–29 November
Puebla: 4229	29 November
Hidalgo: 4230–4234	30 November

Jennie's last trips to Mexico were in 1972. She was promoted from Herbarium Botanist to Assistant Curator in September. In her report to the Director for 1972–73 she mentioned her attendance in St. Louis, Missouri, at the annual symposium on systematics in October. She later visited Mexico City to attend the First Latin American Botanical Congress, lodging for the period December 1–8, 1972, at Hotel Versailles, where Annetta Carter was also staying. Before the St. Louis meeting, Jennie managed to arrange a short collecting trip to Michoacán and Jalisco, on which she was accompanied by Carol Nimke, the Herbarium Secretary. I have no details on this excursion except the records of her collections from her fieldbooks:

Michoacán: 4243–4419	4–13 September
Jalisco: 4420–4431	14 September

As her field-experience with the Mexican cucurbits increased, Jennie more and more began to concentrate on finding living populations of species and genera that were of special interest to her, and those she had not seen previously. It was in 1972 that she was able to find and collect the material on which she later based the new genera *Apatzingania* (Dieterle 4379) and *Chalema* (Dieterle 4307).

Between 1958, the year of her trip to Europe, and 1973, Jennie accomplished her most significant research on the Cucurbitaceae and became known internationally for her work. To add to her knowledge of morphology, geographical distribution, and breeding patterns, she undertook a study of pollen diversity through the use of the Scanning Electron Microscope, which at that time was a developing technique. From January to June, 1973, she used the University's SEM Laboratory for a total of 54.5 hours, the third largest number of hours among the 30 users of the instrument from the College of Literature, Science, and the Arts. The high quality of the resultant photographs of pollen grains is clear from the 12 examples published to accompany her treatment of the family in the *Flora of Guatemala* (Part 11, no. 4, pages 390–395, figures 35–46. 1976).

It is appropriate to add here an appraisal of Jennie's work, by an internationally known student of Mexican cucurbits, Dr. Rafael Lira-Saade. At my request he submitted the following, which I put into English that imperfectly expresses the feelings in the original Spanish:

"In all walks of life there are persons whose work, although not necessarily monumental in scope, has a strong impact on the community for which it is intended. Such was the floristic and taxonomic work on the Cucurbitaceae of Jennie Van Akkeren Dieterle, whom unfortunately I never had the pleasure of meeting. My first contact with her work, which proved to be of great importance in my professional career, was in 1983 when I was beginning as curator of an herbarium in Yucatán, and found myself needing to identify some dozens of specimens of that family, and also to find a subject for my Master's Thesis.

"The problem of identification proved to be very pleasant and easy with the aid of Mrs. Dieterle's treatment [for the Cucurbitaceae of Guatemala]. Two outstanding features of that work are the detail and precision that characterize the description of the family, and the keys to identification of genera, including one for material with staminate flowers, and a second key for material with fruits only. We who study the Cucurbitaceae know the value of that, as it is very seldom that one can find all the necessary structures in a single specimen.

"Study of the Cucurbitaceae of Guatemala also made it easy for me to decide upon a topic for my thesis, which developed into a taxonomic and ethnobotanical study of the Cucurbitaceae of the Yucatán Peninsula, and eventually led to a lifelong interest. From that day to this I have devoted my time and my professional interest to the study of these plants as they grow in my country.

"Quite apart from her publications, Mrs. Dieterle's numerous botanical specimens were always carefully prepared and fully annotated, making them unusually valuable. One such specimen was of a plant in the genus *Sicyos*, which is certainly one of the most difficult genera of the Cucurbitaceae. Her notes on the specimen alerted one of my students to the realization that perhaps the species was new to science. This was

confirmed by further study, and in 1999 the new species was published as *Sicyos dieterleae* Rodríguez-Arévalo & Lira.

"It is also obvious from the notes on Mrs. Dieterle's specimens that she made a special attempt to collect from plants that were unusual, rare, or otherwise interesting. One such collection, her number 3640, taken from a roadside habitat in 1969, still constitutes the only record of the wild *chayote*, *Sechium edule* subsp. *sylvestre*, that we have from the State of Puebla.

"Similar examples are surely known to all those who have studied the Cucurbitaceae of Mexico. To them, as to me, Mrs. Dieterle's 'good taxonomic eye' must have provided many an assist to their scientific careers."

On November 12, 1973, Jennie sustained what her attending physician called an "acute cerebrovascular accident," or what was generally thought of as a rather mild stroke. This affected her left side in particular, including her eyesight, her muscular control, and to some extent her concentration. On December 7 she wrote to the Director of the Herbarium, in what seemed to be perfectly normal handwriting, that it might be some time before she could resume her duties at the Herbarium. She was sufficiently recovered to submit a detailed annual report of 37 pages, on the activity in the Herbarium through June 30, 1974, but of herself she said only: "My own work was suddenly interrupted because of an arterial thrombosis suffered in November. This illness necessitated a complete absence from the Herbarium until the latter part of April, and allowed only shortened workdays for the remainder of the year. My research, principally concerned with the cucurbits of Guatemala and Mexico, and with examination of cucurbit pollen under the scanning electronic microscope, was halted. However, a paper on a geocarpic cucurbit from Mexico, written earlier, reached publication."

She continued both her curatorial duties and her research in spite of her handicaps. In her detailed report for 1974–75 she summarized her activities in a few lines: "As in the past, my time was given chiefly to general herbarium management: Supervision of the mounting and preparatorial staff, record-keeping, accessioning, miscellaneous curatorial duties, etc. My research activity continued as work on a compilation of the Cucurbitaceae of Guatemala. I still have, after two years of convalescence, some minor stroke-related disability, which may be permanent. It seems wise to request retirement as soon as a replacement can be arranged."

In my (Curator's) report to the Director, October 10, 1975, I added: "It is true that her recovery from her stroke in November 1973 has been less rapid than her doctor predicted.... In addition she has lost some self-confidence. She has continued to work on the treatment of the Cucurbitaceae for the Flora of Guatemala, but she goes very slowly, with much help from the staff at Chicago."

At the end of the following fiscal year, 1975–76, her Assistant Curator's report summarized as before her regular duties, but she said, "My ability to pursue these activities is lowered. I would welcome retirement and freedom to devote all my time to the study of the Cucurbitaceae." She continued modestly, "The manuscript for the Cucurbitaceae for the Flora of Guatemala has been completed. It is now being printed. I am continuing, as time permits, with work on Mexican Cucurbitaceae."

Whether or not Jennie was able to perform her duties as well as before, her report shows that she had lost nothing of her judgments of people and her ability

to write pithily and clearly about them. In discussing the work of the plant mounters under her charge, she diagnosed both their weak and their strong points in detail, without recommendations for action, but evidently to alert the director to the weaknesses and strengths in his staff.

In my (Curator's) report of October 14, 1976, I was able to say of the Cucurbitaceae of Guatemala: "It is in press, and in fact should be out any day now. It will be a great credit to her and to the Herbarium to have a contribution in the prestigious *Flora of Guatemala*, which is by all odds the best flora now available for any part of Latin America."

The pertinent part of the *Flora* that included the cucurbits (part 11, number 4, pages 275–431) was issued on October 20, 1976. Some months previous to this, the final typing of the manuscript had been completed by Dorothy L. Nash of the Field Museum staff, who came and worked with Jennie in Ann Arbor, and put Jennie's data and ideas and manuscripts into the stylized format of the *Flora of Guatemala*, which was complete with this last part.

Unfortunately Jennie could not finish the comparable treatment of that family for the *Flora Novo-Galiciana*, which she had undertaken at my request, and in support of which she had carried on her field-excursions in Mexico in the 1960s. She laid a firm foundation for future work, however, by working closely with Karin Douthit, the artist who since 1969 has prepared the majority of the black-and-white illustrations that adorn the pages of the *Flora*. Between Jennie's detailed knowledge of the complex structure of the cucurbit flowers, and the details that were absolutely essential to show in the drawings, on the one hand, and Karin's knowledge of what could in fact be shown in pen and ink at the desired magnification, the two of them produced, complete to the finest detail, more than half of the drawings that would ultimately be needed. With those for a model, it was relatively easy for me to work with Karin to complete the job 20 years later, along the lines that Jennie had laid down.

Now that the time has come when the Cucurbitaceae of Nueva Galicia may be published in the foreseeable future, it is a great pleasure to say here that it could never have been completed without Jennie's detailed notes and sketches of dissected flowers, her manuscript descriptions, her hundreds of annotations on herbarium specimens, her contribution to the drawings that will illustrate the finished work, and her field excursions that so greatly increased our knowledge of the living plants.

Her influence lingers on in the Michigan Herbarium today. The present Curator, A. A. Reznicek, wrote to me in April, 2000, "though everything is now computerized, the kinds of data we record and the diligence with which we (try) to record things follow Jennie's example, as do labeling of bundles and many of our other curatorial practices, such as our 'City' file for curatorial records. The details may differ but the thoroughness and care she took we hope we have maintained."

It is hoped that this brief chronicle will illustrate how continuing, inspired efforts by a relatively small number of individuals may result in the creation of a storehouse of knowledge with international repute. At the same time it is our wish to express appreciation for one of those scholars, Jennie Dieterle, who loved and lived her discipline every day of her life, and whose dedicated work greatly contributed to the present stature of the University of Michigan Herbarium.

BOTANICAL PUBLICATIONS BY JENNIE V. A. DIETERLE

- Sandbags as a technical aid in mounting plants. *Rhodora* 62: 322–324. 1960.
- A new geocarpic genus from Mexico: *Apatzingania* (Cucurbitaceae). *Brittonia* 26: 129–132. 1974.
- Parasicyos maculatus*, a new genus and species of Cucurbitaceae from Guatemala. *Phytologia* 32: 289–290. 1975.
- Cucurbitaceae, Gourd Family. *In* Flora of Guatemala. *Fieldiana* 24, pt. 11: 306–395. 1976.
- Two new Cucurbitaceae from Mexico. *Contr. Univ. Michigan Herb.* 14: 69–73. 1980. [*Chalema synanthera*, new genus and species; *Sechiopsis tetraptera*, new species].

JENNIE VAN AKKEREN DIETERLE

1909–1999

Caroline Dieterle
Iowa City, Iowa 52240

Jennie Van Akkeren Dieterle—my mother—was a scholar, a dedicated staff member at the University of Michigan Herbarium, an authority on the American Cucurbitaceae, and a founding member of the Huron Valley Chapter of The Michigan Botanical Club. She was a woman ahead of her time in terms of educational level attained and independence of thought; that she also truly lived her scholarly discipline all of her life—not only in her professional activities but in her pastimes and in the methods and attitudes she brought to her family life—is notable and unusual: if “botanical talent” were recognized as artistic talent is, she would be said to have had it.

My grandparents were recent immigrants from Holland, gardeners and florists; some of Mother’s earliest memories were of her parents working together in a greenhouse while she and her brother John (who later became a forester) played under the benches. Living on the grounds of the University of Michigan Botanical Gardens (the old location), where her father had become employed as a gardener, meant that she literally grew up among plants; she knew Professor Harley H. Bartlett from her childhood days at the Gardens and, as “an honorary niece”—which she always explained proudly—she called him “Uncle Harley.”

I knew that plants were very important to my mother virtually from the time I came to consciousness—and not until I met other children’s parents did I realize how different and special she was in this regard.

In contrast to my friends’ mothers, she also was very indulgent in ways we appreciated: she let my brother and me roller-skate in the house. My brother was born on Christmas Eve, and because everyone was too busy with Christmas to give him a feeling of being special on his birthday, she invented the “Halfy Birthday,” celebrating June 24th as his birthday instead. She read “Rabbit Hill,” “Alice in Wonderland,” and “The Camel with the Wrinkled Knees” to us, some of her favorites. When we were having lots of cavities in our teeth and could not have sugary treats, she made paraffin chewing gum for us with mint flavoring. She took us swimming at the lake and was a good swimmer herself. She was a good ice skater. She carried a pocketknife and let us have them, too. When a neighbor called to complain angrily that I had scared her terribly by hanging by my knees from a tree branch over the road, Mother did not punish me but told me to hang by my knees somewhere else that wouldn’t cause trouble.

She never called us ‘honey’ or ‘dear’ and considered public displays of affection in bad taste—but I knew she loved us dearly. She expected us to endure pain bravely, but did all she possibly could to relieve it when we were sick or hurt.

We picked wild strawberries and wild black raspberries together; we went into our woods for picnics. We gathered walnuts and hickory nuts. In the spring, she took us to the woods to see—but not pick!—the spring wild flowers. I learned



Jennie Van Akkeren at age 19

from her the ethic for wild flowers that later was expressed in a Michigan Botanical Club poster: "Let them live in your eye, not die in your hand." Sometimes we found giant puffballs, and she showed us that they were good to eat, frying breaded slices of them for supper. She knew a lot about animals and insects, too—which ones posed hazards and which ones were harmless—as well as the important principles of interrupting the life cycles of those that were undesirable in order to eliminate them, and of removing whatever would attract them in the first place. (Thanks to her instruction, I have never had problems with clothes moths, mice, ants, roaches, or other household pests.) I remember being shown how to pick up a garter snake, and being told that they were a valuable help in the garden and that I should not be afraid of all snakes. She referred to 'clean bugs' as something not to worry about when picking and eating wild berries, saying that, after all, they lived on what we also were eating and not on anything dirty like manure. She showed me how caterpillars become butterflies. We watched tadpoles turn into frogs. My brother wanted to know what crow tasted like—when he shot one, she cooked it for him. She took him fishing and got him interested in turtles, so that he learned the natural history of all those that are native to southern Michigan. My daughter Jennie, her namesake, remembers her grandmother taking her for a walk around the farm when she was still quite small and showing her how to make "wheat gum" by chewing green kernels of wheat, and how to make a fire with a magnifying glass.

Because she and my father had bought 80 acres of farmland and woods, there was plenty of room for gardening. Besides the vegetable garden, she planted bulbs and perennials all around the yard and had beautiful flower beds. She went through the discard piles at the Botanical Gardens and salvaged irises and “spent” bulbs to replant—and they always flourished. A greenhouse was built onto the south side of the garage and used continually for many years. By watching her I learned how to plant and care for a garden, how to start seedlings and do transplants, how to mix soil and make compost. She told me that “nothing goes to waste, because *something eats everything*.” She also quoted a little verse about the food chain:

“Bigger bugs have lesser bugs
Upon their backs to bite them;
And lesser bugs have littler ones,
And so on—ad infinitum!”

Her knowledge of science was ingrained and second nature: her 20 years away from formal participation (1937–57) did not result in her becoming “rusty.” She read serious books and journals in the evenings—I don’t remember ever seeing a “women’s magazine” in the house. *Scientific American* and the Sigma Xi journal were there instead.

I went to my high school physics class the day after ‘Parents’ Night’ and was greeted ecstatically by my teacher. My mother had had the same teacher many years before. Apparently the previous evening he had posed a physics problem to the assembled parents and asked if anyone knew how to solve it. My mother had gotten right up and done the job, and then reminded him that he himself had taught her how to do it. Typically, she had not mentioned this to me herself that morning.

I did well academically because of her example and learned important principles from her that have served me well all my life; some examples are:

“No solution to any problem is more exact than the least exact quantity used in the calculation.”

“No system is any stronger than the weakest link in it.”

“Always check your work, asking first whether the answer makes sense in relation to the situation and the scale of the components and then working backwards from the answer to check for errors in computation.”

“If you are making no progress in solving a problem you are likely asking yourself the wrong questions—try approaching from a different perspective.”

When I became a mother myself, I realized how well she had done a difficult task. Upon being told I was expecting my first child, she said with characteristic brevity that came straight to the point: “You will find that being a mother can be very trying at times, but in the end you will see that it was all very worth doing.”

The similarly brief advice she offered on child rearing was solid: “never use baby talk with your children—it’s bad for their English and insults their intelligence”; “if you lose control when they are 2 years old, you have lost it for good.”

She truly taught by example the most valuable knowledge I have: what love is, the importance of being fair and being kind, that the measure of being a ‘lady’ is whether one thinks of other people’s feelings—that personal modesty, cleanliness, and table manners are simply ways of being considerate of others—and that it has nothing at all to do with stuffiness or snobbery. She said that using obscenities was simply “an indication of a poor vocabulary.”

She had a good sense of humor (we shared an appreciation for “Far Side” cartoons); and she knew when to take time out to celebrate a job well done: she’d say, “Shall we dissipate now?” and we would have some tea and a snack or a glass of wine. Almond Joy bars or any form of chocolate with nuts were favorites of hers. Arduous, tiring tasks that resulted in fatigue led to our invention of “dead bug syndrome”—which was lying down on one’s back with all four appendages raised straight up in the air—to express that.

When I was a sophomore at the University of Michigan who had already tried and abandoned History, German, and Classics majors because my interest in them was not deep enough, I was worrying aloud one day and her only comment was, “I do not consider any person truly educated who has not taken at least one college biology course.” I had not. I hadn’t even taken high school biology. I registered for Botany I the next term, and was hooked on the Botany major on the day I looked through the microscope in one of the first lab exercises and saw streaming cytoplasm in a green cell. I only regret that I “saw the light” that late, because when I was in high school I had gone along on many of her forays to collect specimens eventually used in the Michigan Flora project. I sat in the car, reading and guarding the equipment, a sort of ‘safety measure’ in case of accident; I got a lot of classics read but learned no botany. The one time it was truly useful that I was along was when she was collecting aquatic plants using a rowboat and a grapple; I was rowing the boat. The grapple caught on something especially resistant, she overbalanced and fell in—a big surprise to us both.

About this time, she started to work at the Herbarium and was obviously so very happy to be back among other people interested in plants in a scholarly way. When I visited her in the Herbarium she seemed to be blooming there. She became acquainted with the graduate students working in the mycology collections, some of whom were growing cultures; at Christmas, with a smile, she told me that she had left them a bushel basket of manure wrapped in holiday paper with a note that said, “Merry Christmas from the Staff.”

Social occasions at home began to include her colleagues and their conversations about botany. Formerly, the guest lists had been limited largely to people my father knew; and after a long drawn-out discussion of some psychological theory or philosophical point, she would simply say mildly ‘all of that’s all very well, but what’s for dinner?’—underlining her preference for considering practical realities. She was a wonderful cook and gracious hostess, and I doubt that this rejoinder offended anyone. However, the entertaining of Botany people resulted in table conversations that were quite different: a good example is the time Rup Chand was there and showed us how to make cotton thread using just his hands, a wad of surgical cotton, a small stick, and an empty thread spool.

One of her colleagues, Eric Hultén from Sweden, came to the farm several times while he was visiting the University of Michigan Herbarium. On one late winter occasion, he brought along a folding cot or lounge chair of some kind and lay out on it in the sun in nothing but a pair of shorts amidst the melting snow on the south lawn of the house. This amazed us all.

I sent her some botanical postage stamps I found, and she started a stamp collection of exclusively botanical stamps. We both had a lot of fun with that. We had always enjoyed doing jigsaw puzzles; eventually the 1000-piece-type turned

into a group project when the family was home for a holiday, and the puzzle picture always featured plants.

When she was considering going on her first collecting trip in Mexico my grandmother was in frail health, so Mother was hesitating even though she very much wanted to go. She asked me what I thought about it. I asked her in reply whether there were any unresolved issues between them. There were not, and my grandmother was telling her to go. I then asked her whether she would want me to stay home if the two of us were in the same situation. She immediately replied, 'No!' and decided to go.

While she was packing to leave, my brother gave her a leather belt with a gun holster on it to carry her trowel in. Mother later said that on a few occasions while out in the bush she became aware of being watched by strange men but that they all kept their distance; she thought that because the top of the holster was covered by her shirt or jacket they might have thought she was armed.

On the first trip, she called home in distress after about a week—did not feel at all well and didn't know what to do. My father correctly diagnosed the cause as over-caffeination from the cola drinks they were using in large quantity to stay hydrated and avoid digestive problems from the water. Changing drinks took care of the problem.

When her collecting party emerged from the bush in the fall of 1963, the first Mexicans they met told them about President Kennedy's assassination; they at first thought that either they were misunderstanding what was said or that it was some sort of joke.

I was very glad that Mother finally had the opportunity to travel not only to Mexico but to Europe to visit herbaria there, because for so many years she had heard my father and his friends talk about their travels. When I was still a child she had started a 'travel savings fund' into which she and I put the small change that we found in such places as under the couch cushions; it was a symbol to me of her optimism and belief that doing something constructive—however small—to solve a problem was better than doing nothing.

When I had children I became occupied with domestic duties of my own and could only cheer her on as her professional career advanced. I remember her exclamations of amazement and delight at the use of the electron microscope—a wonderful new tool for her research. She began to publish articles and had increased responsibility at the Herbarium as well as more travel. She wondered aloud whether it was worthwhile to publish her first article—about sand bag use in the Herbarium—because to her it was such a simple and obvious solution; in reply, I reminded her of one of her own dicta: "The most difficult problem, once solved, appears relatively simple." She was always very critical of her own work and seemed pleasantly surprised at any approbation she received. When we were together and I asked her how things were going with her work, she would describe rather shyly and diffidently her activities and achievements; but the pleasure she took in her professional life was quietly evident. Cucurbits were long-standing garden favorites—I loved them too because of their growth habit, big leaves, and ambitious tendrils. She used the word "jolly" to describe them, and when I was 3–4 years old she had made me a cloth doll with a pumpkin head (*papier-mâché*?) called "Billy Bounce." Either she had been interested in them a long time indeed or had followed up on our gardening by looking into the literature about the family and then deciding to focus on it.



In a cotton field on the way to Mexico, 1963



Collecting in Mexico, 1969



At home by the walnut tree, ca. 1975

Unfortunately, we lived far from Ann Arbor. She was a treasured grandmother, and when we had a visit my children would weep when it was time to part—making it even harder for me to say goodbye myself. We fell into the custom of always having lentil soup as a sort of pledge of another visit soon. She used the same organizational and coping skills that benefited the Herbarium so much when she came to my rescue on some very trying occasions: for example, when the date for moving my household fell only a week or so after the arrival of my second child. During later visits, she and my daughter Jennie would do the mending as a way to help me out, pretending that the clothes ‘needed an operation’; Jennie would present the case, and then pull the basting threads and trim the ends after Mother had sewn up the tear or mended the hole. Jennie is now an accomplished seamstress who has taught sewing classes herself.

I see my mother’s influence in all my children as well as in myself and am very thankful for that. I realize how lucky I was to have her, and that she was the best mother a person like me could have had.

Because of my own family responsibilities, I was never in a position to be able to enjoy her company as a fellow expedition member; I regret that, because her incisive logic, excellent sense of humor, coping skills, courage in adversity, and strong attitude of fairness must have made her a very good person with whom to share both the pleasures and travails of field work.

When in 1992 it became obvious that she would have to stay at a retirement home, we talked about that and she quoted from the Rubaiyat of Omar Khayyam:

“Ah love! Could you and I with him conspire
To grasp this sorry Scheme of Things entire,
Would not we shatter it to bits—and then
Re-mould it nearer to the Heart’s Desire!”



At home on the farm, ca. 1989

In our conversations in the last few years, when we talked of the meaning of life and death, the incredible intricacy of living things, and the wonder of existence itself, she seemed to take comfort in, and agree with, J. B. S. Haldane's remark:

“My suspicion is that the universe is not only queerer than we suppose, but queerer than we can suppose.”

I hope that wherever her soul now is, she is finding out more about the universe and is being pleasantly surprised.

TWO NEW SPECIES OF HETEROPTERYYS (MALPIGHIACEAE) FROM SOUTHEASTERN BRAZIL

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ABSTRACT. *Heteropterys fragilis* and *H. occhionii*, two new species of *Heteropterys* H. B. K. Subsection *Aptychia* Nied. (Malpighiaceae), are described and illustrated, and their affinities with related taxa discussed. Both species occur in the Brazilian Atlantic forest in the state of Rio de Janeiro.

RESUMO. *Heteropterys fragilis* e *H. occhionii*, duas novas espécies de *Heteropterys* H. B. K. Subsection *Aptychia* Nied. (Malpighiaceae), são descritas e ilustradas, e suas afinidades taxonômicas são discutidas. Ambas as espécies ocorrem em floresta Atlântica no Estado do Rio de Janeiro, Brasil.

The two new species here described are assigned to *Heteropterys* Subsection *Aptychia* Nied. (Malpighiaceae). They are known only from the state of Rio de Janeiro, Brazil. *Heteropterys fragilis* occurs in the Atlantic forest and *H. occhionii* presumably in similar habitat.

Heteropterys fragilis Amorim, sp. nov.—TYPE: BRAZIL. Rio de Janeiro: Estação Ecológica Estadual de Paraíso, Mpio. Guapimirim, 22°27–31'S, 42°50–56'W, trilha a esquerda da Estação de Tratamento de Água, 28 Oct 1999 fl/fr, A. M. Amorim, S. J. Neto & J. Caruso 3146 (holotype: CEPEC!; isotypes: MBM! MICH! RB! SP!). Fig. 1.

Liana sublignosa, ramis mox glabrescentibus; lamina foliorum majorum 5.3–12.5 cm longa, 0.9–3.1 cm lata, membranacea, elliptica, lanceolata, oblongo-lanceolata, vel falciformis, margine ciliata, utrinque glabrata; petiolus 2–5 mm longus, glabratus, base biglandulosus. Panicula 2.5–11 cm longa, in ramis deflexis, floribus in umbellis 4–6-floris; bractae margine ciliatae, juxta basim biglandulosae; flores pedunculis nullis, pedicellis 5.5–7 mm longis, incrassatis versus apicem. Petala lutea, exposita in alabastro, dorso carinato; petala margine erosa; styli apice dorsaliter rotundati. Samarae 19–21 mm longae, 9–10 mm latae, nux laevis.

Woody vine, climbing to 1.5–6 m; stems cylindrical to sulcate, twisted, initially tomentose and soon glabrate, developing small scattered lenticels on the basal stems. Leaves opposite; petiole 2–5 mm long, tomentose to eventually glabrate, bearing a pair of prominent glands at base, each gland 1.1–1.3 mm in diameter; stipules ca. 0.1–0.2 mm long, borne on the base of the petiole; lamina of larger leaves (5.3–) 8.8–12.5 cm long, (0.9–) 1.4–3.1 cm wide, membranous, elliptical, lanceolate to oblong-lanceolate, or sometimes falcate, obtuse to slightly cordate at base, acute to cuspidate at apex, margins with irregularly spaced vascularized cilia, especially in young leaves, soon deciduous or persistent near the apex; hairs sessile or subsessile, nearly straight and strongly appressed or long-stalked, forming a dense indument on primary and secondary veins on both sides, later deciduous or persistent on the abaxial surface; adaxial surface with impressed veins. Inflorescence a small panicle, terminal or axillary, pendulous, initially tomentose

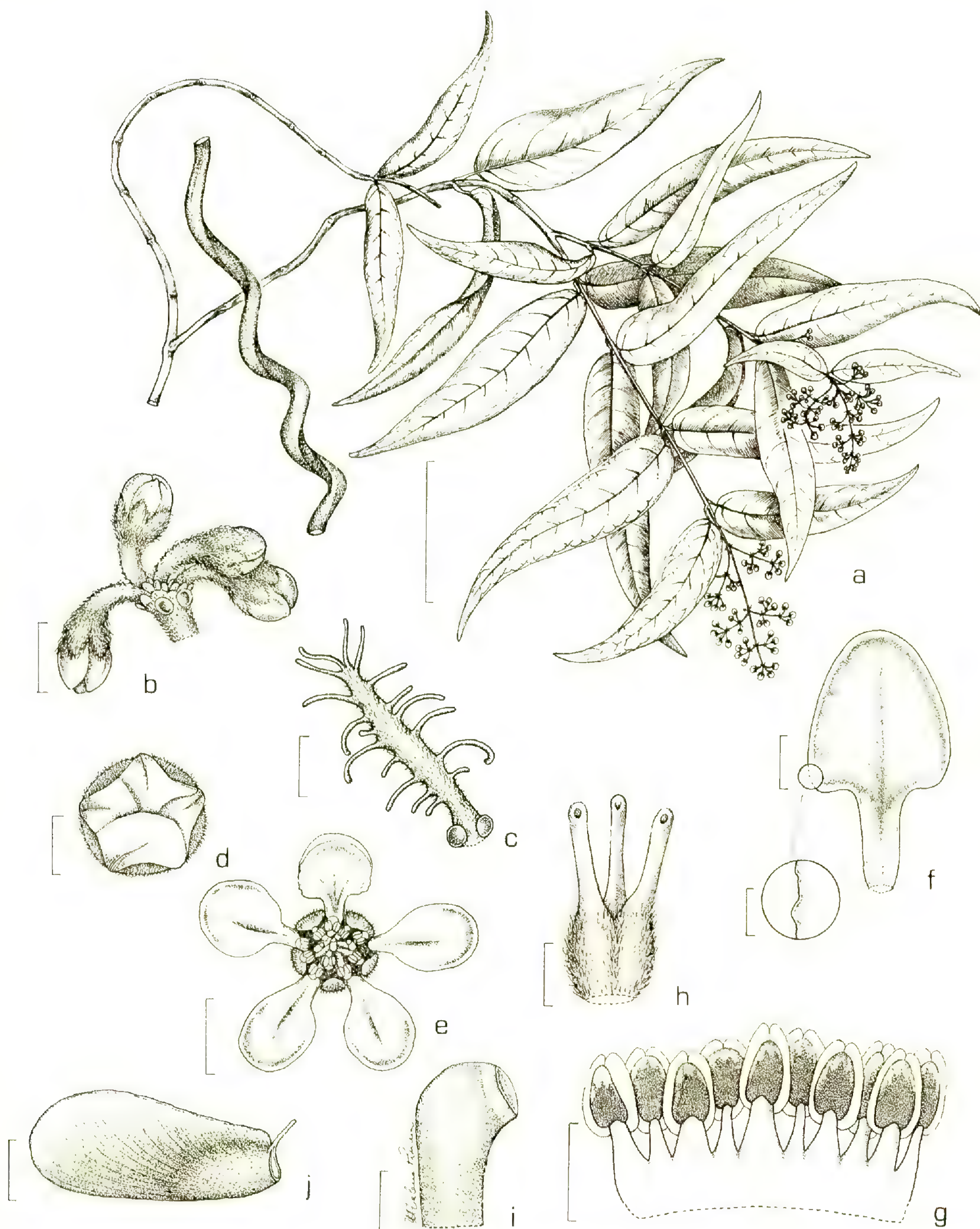


FIG. 1. *Heteropterys fragilis*. a) flowering branch with detail of basal stem; b) umbel of flower buds; c) inflorescence bract; d) flower bud from above; e) flower from above; f) posterior petal with portion of margin enlarged; g) androecium, laid out, abaxial view, the stamen second from right opposite the posterior petal, stamen fourth from left opposite the anterior sepal; h) gynoecium, anterior style in middle; i) detail of apex of 1 style; j) samara. Scale bars: a, 5 cm; b, 4 mm; c-d, 1.5 mm; e, 3 mm; f, 1 mm (petal) and 0.25 mm (margin); g, 2 mm; h, 1 mm; i, 0.25 mm; j, 5 mm. (Based on Amorim 3146.)

to glabrate, (2.5-) 3.5-8 (-11) cm long, primary branches 4-10, 0.5-3.5 cm long, secondary branches 4-8, 0.3-0.6 cm long, the ultimate units 4-6-flowered umbels; inflorescence bracts ca. 5.5 mm long, 0.6-0.8 mm wide, linear, ciliate on the margins, biglandular at base, the glands ca. 1 mm long, bright green; peduncle absent;

bracts 0.6–0.7 mm long, 0.7–0.8 mm wide, ovate, eglandular, abaxially tomentose, adaxially glabrous; bracteoles like bracts but smaller, eglandular; pedicel 5.5–7 mm long, 0.9–1.8 mm wide (7–9 mm long, ca. 2.2 mm wide in fruit), tomentose, somewhat thicker distally. Sepals 1.6–1.8 mm long, 1.1–1.4 mm wide, pale brown, rounded at apex, abaxially tomentose, adaxially glabrous, eglandular. Petals exposed in the enlarging bud, yellow, glabrous, slightly erose at margin, abaxially keeled; lateral petals spreading, claw ca. 1.4 mm long, limb 4.7–4.9 mm long, 2.3–2.5 mm wide; posterior petal erect, claw ca. 2.1 mm long, limb 3–5.2 mm long, 2.7–2.9 mm wide. Stamens glabrous, unequal; filaments 1.9–2.2 mm long, 0.2–0.7 mm wide, connate ca. 1/2 their length; anthers 1.6–1.8 mm long, all alike, glabrous, erect to reflexed, connective proximally 2/3–4/5 dark red, the distal 1/3–1/5 white. Ovary ca. 1.5 mm high, thinly tomentose; styles 2.3–2.5 mm long, erect and straight, equalling or slightly exceeding the anthers, the posterior 2 rotated so that all 3 stigmas face toward posterior petal, glabrous, rounded dorsally at the apex, the stigma internal. Samara pale brown, 19–21 mm long, borne horizontally, sparsely tomentose; dorsal wing almost as long as samara, ca. 16 mm long, 9–10 mm wide, nut 4.6–8.5 mm in diameter, ovoid, smooth-sided, without lateral crests or winglets.

ADDITIONAL SPECIMENS EXAMINED. **Brazil.** RIO DE JANEIRO: Mpio. Magé: Área do Centro de Primatologia do Rio de Janeiro, 14 Oct 1984 fl, *Lima et al.* 2179 (RB, SP); Estação Ecológica de Paraíso, próximo a Estação de Tratamento de Água, 18 Oct 1991 fl, *Gomes et al.* 432 (CEPEC, RB); Estação Ecológica de Paraíso, 28 Nov 1991 fl, *Lima et al.* 4335 (RB); Serra dos Órgãos, [Mpio. Teresópolis], Caneca-Fria, Dec 1974 fl, *Occhioni* 6631 (CEPEC, MICH, RFA).

Heteropterys fragilis is distinguished by its leaves with a short petiole and membranous, lanceolate to oblong-lanceolate or falcate lamina, which is obtuse to slightly cordate at base and soon glabrate on both surfaces. Also, it has linear inflorescence bracts with ciliate margins, petals with an erose margin, styles rounded dorsally at the apex, and stigmas facing toward the posterior petal. The samara is borne horizontally, its nut smooth-sided, without lateral crests or winglets.

This species belongs to Series *Holopetalum* (Griseb.) Nied., characterized principally by sessile pedicels, yellow petals, and a lamina not persistently metallic-sericeous below (Anderson 1982). It is related to *H. crinigera* Griseb., sharing a similar lamina shape, vesture (especially *Occhioni* 6631), and rounded style apex. This last character is rare for the series; almost all species show a pedaliform or short-appendiculate style apex. The following couplet presents the distinguishing characters for these two species:

1. Petiole 2–5 mm long, lamina (5.3–) 8.8–12.5 cm long, (0.9–) 1.4–3.1 cm wide; inflorescence bracts ca. 5.5 mm long, margins ciliate; petals slightly erose at margin; styles 2.3–2.5 mm long, erect and straight, all stigmas facing toward the posterior petal; samara 19–21 mm long, the nut ovoid, smooth-sided. *H. fragilis.*
1. Petiole (6–) 10–15 mm long, lamina (9.5–) 12–18.3 cm long, 4.8–5.5 cm wide; inflorescence bracts 1.3 mm long, margins entire; lateral petals erose and posterior petal denticulate at margin; styles ca. 5.5 mm long, slightly arcuate at base, all stigmas facing toward the center of the flower; samara 30–38 mm long, the nut subspheroidal, with prominent longitudinal nerves. *H. crinigera.*

Heteropterys fragilis occurs in a restricted area adjacent to the National Park of Serra dos Órgãos in the state of Rio de Janeiro, between 200 and 600 m elevation. It is a slender vine growing below the canopy of Atlantic forest. The specific epithet refers to the delicate aspect of the whole plant.

Heteropterys occhionii Amorim, sp. nov.—TYPE: BRAZIL. Rio de Janeiro: Mpio. Itatiaia, Parque Nacional do Itatiaia, May 1977 fl, *P. Occhioni* 8213 (holotype: RFA!; isotypes: CEPEC! MBM! MICH! RB!). Fig. 2.

Liana sublignosa, ramis mox glabrescentibus; lamina foliorum majorum 5.9–12.5 cm longa, 1.5–3.7 cm lata, lanceolata vel oblongo-lanceolata, margine sinuata, utrinque glabrata, abaxialiter aliquot glandulis parvis munita, reticulo utrinque prominenti; petiolus 7–12 mm longus, glabratus, base biglandulosus. Panicula 7–15 cm longa, in ramis deflexis; umbellae 4–5-florae interdum 2 floribus proximalibus adjectis; flores pedunculis nullis, pedicellis 7.3–8.3 mm longis, delicatis. Petala flava, exposita in alabastro, valde reflexa, decidua, abaxialiter plana, margine erosa; styli apice truncati, 1.6–2.9 mm longi.

Slender vine; stems evidently 4-angled, initially sericeous, soon glabrate. Leaves opposite; petiole 7–12 mm long, sericeous to glabrate, bearing a pair of impressed glands at base, each gland ca. 0.8 mm in diameter; stipules ca. 0.2–0.3 mm long, borne on petiole in the proximal half, apparently often absent; lamina of larger leaves (5.9–) 8–12.5 cm long, 1.5–3.7 cm wide, papery, broadly lanceolate to oblong-lanceolate or sometimes linear-lanceolate, cuneate to slightly obtuse at base, acute to apiculate at apex, widely sinuate at margins, bearing a series of small sessile submarginal glands, often in sinuses, sparsely sericeous to glabrescent, with the hairs sessile or subsessile and appressed, later deciduous or persistent on midrib, especially below; lateral veins visible above, lateral veins and reticulum visible below. Inflorescence paniculate, terminal, pendulous, densely sericeous, (7–) 11.2–15 cm long, the main axis elongated, primary branches 8–12, loosely arranged, 0.4–4.6 cm long, secondary branches rarely developed, the flowers borne ultimately in 4–5-flowered umbels, occasionally with an additional pair of flowers borne more proximally; inflorescence bracts 3.7–7.8 mm long, 1.1–1.4 mm wide, linear-lanceolate, entire at margins, eglandular or biglandular at base, the glands 0.3–0.5 mm long; peduncle absent; bracts ca. 0.7 mm long, 0.4 mm wide, ovate, eglandular, abaxially sericeous, adaxially glabrous; bracteoles like bracts but smaller, eglandular; pedicel 7.3–8.3 mm long, 0.5–1 mm wide, slender, straight, densely sericeous. Sepals 2–2.2 mm long, 1.2–1.5 mm wide, rounded at apex, abaxially sericeous, adaxially glabrous, eglandular. Petals exposed in the enlarging bud, pale yellow, translucent, glabrous, abaxially smooth, all 5 reflexed in anthesis, often deciduous, slightly erose at the margin; lateral petals 5.3–5.5 mm long, 1.7 mm wide, claw ca. 2 mm long; posterior petal 4.8 mm long, ca. 1.7 mm wide, the thick claw ca. 2 mm long. Stamens glabrous, subequal; filaments 1.6–2.9 mm long, 0.2–0.7 mm wide, connate ca. 1/2 their length; anthers 1.2–1.5 mm long, all alike, glabrous, reflexed, the connective uniformly brown. Ovary ca. 1.5 mm high, densely sericeous; styles 3.7–4.2 mm long, glabrous, slender, exceeding the anthers, the anterior slightly divergent, truncate at apex. Samara not seen.

Heteropterys occhionii is readily distinguished from other taxa by its elongated and lax inflorescences with each branch terminating in an umbel of 4–5 flowers (occasionally with an additional pair of flowers borne more proximally), slender pedicels, and long styles exceeding the anthers and truncate at the apex. It is allied with a group of species with sessile pedicels and petals strongly reflexed during anthesis.

Heteropterys occhionii resembles *H. ternstroemiifolia* Adr. Juss. in the vesture of the lamina, inflorescence shape, straight pedicels, mostly deciduous translucent petals, and styles truncate at apex. It differs in its lamina, which has a widely

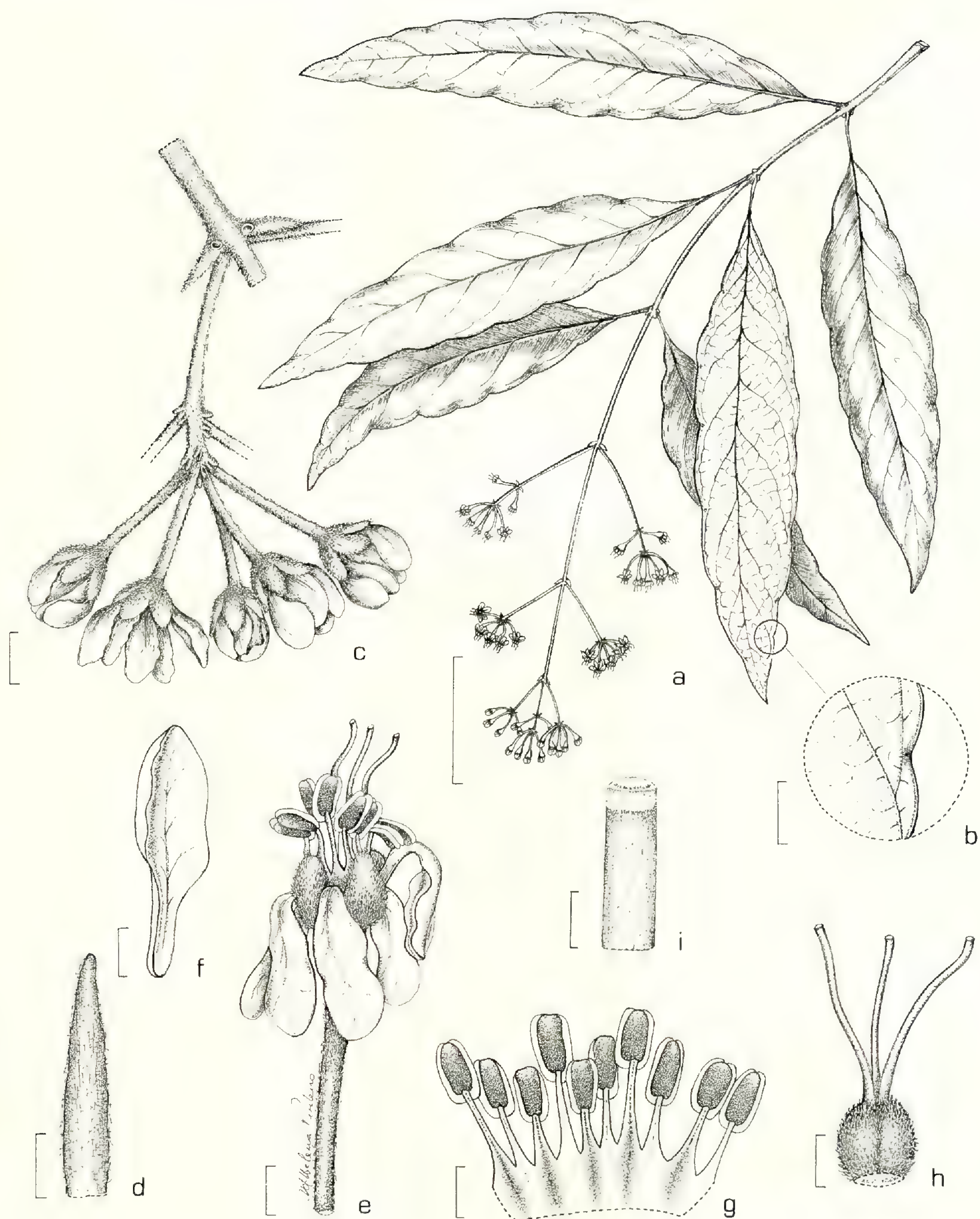


FIG. 2. *Heteropterys occhionii*. a) flowering branch; b) detail of abaxial surface of lamina; c) umbel of flower buds; d) inflorescence bract; e) flower; f) lateral petal; g) androecium, laid out, abaxial view, the stamen second from right opposite the posterior petal, stamen fourth from left opposite the anterior sepal; h) gynoecium, anterior style in middle; i) detail of apex of 1 style. Scale bars: a, 3 cm; b, 2,5 mm; c, 4 mm; d, e, 2 mm; f, g, 1 mm; h, 1 mm; i, 0.25 mm. (Based on *Occhioni* 8213.)

sinuate margin with a series of small sessile submarginal glands and the reticulum visible below, and also in the linear-lanceolate inflorescence bracts. It also shows several similarities to *H. sanctorum* W. R. Anderson, such as the androecium and style shape. Nevertheless, *H. occhionii* has elongated and terminal inflorescences, whereas those of *H. sanctorum* are short, axillary, and borne on old leafless stems.

This distinctive species, known only from the type collection, was found in the National Park of Itatiaia, in the state of Rio de Janeiro, probably in the Atlantic forest, above 1200 m elevation.

The specific epithet honors Prof. Paulo Occhioni (b. 1915), collector of the type and many other excellent specimens of the southern Brazilian flora, which are housed in the herbarium of the Universidade Federal do Rio de Janeiro (RFA).

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THE IDENTITY OF TWO WATER-DISPERSED SPECIES OF HETEROPTERYS (MALPIGHIACEAE): H. LEONA AND H. PLATYPTERA

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ABSTRACT. A complex in *Heteropterys* composed of water-dispersed species was found to comprise two species, *H. leona* (Cav.) Exell and *H. platyptera* DC., differing most notably in their samaras. *Heteropterys leona* occurs mostly in Atlantic coastal regions, in the New World from Belize to northern Brazil, and in Africa from Senegal to Angola. The synonyms *H. reticulata* (Poir.) Nied. and *H. multiflora* (DC.) Hochr. commonly have been applied to the New World populations and the superfluous name *H. africana* to the Old World representatives. *Heteropterys platyptera*, also known by the synonym *H. longifolia* (Sw.) Nied., is restricted to the Lesser Antilles. The morphology, distribution, and extensive nomenclature are reviewed, and illustrations of the samaras are provided.

INTRODUCTION

The genus *Heteropterys* H. B. K. (Malpighiaceae) comprises well over 100 species found in the Neotropics, except *H. leona* (Cav.) Exell, which occurs also in West Africa. Cavanilles (1790) based his *Banisteria leona* on specimens from Sierra Leone and the New World, and suggested that it had perhaps been introduced to Africa (“fortasse ex America adsportata”). Subsequent authors considered, although hesitatingly, the American and African plants to belong to two separate species, and some also recognized a third species limited to the Lesser Antilles. Current floristic projects of Central and South America prompted a re-examination of this complex and its attendant tangled nomenclature. Two species are recognized here: *H. platyptera* DC. of the Lesser Antilles and *H. leona* (Cav.) Exell, comprising the African and remaining American elements.

MORPHOLOGICAL VARIATION AND DISTRIBUTION

Heteropterys is one of the wing-fruited genera of Malpighiaceae. The fruit is a schizocarp splitting into three samaras. Typically, each samara is composed of a nut bearing an elongated dorsal wing thickened along the lower (abaxial) margin. *Heteropterys platyptera* and *H. leona* grow in wet habitats, and their samaras are modified for dispersal by water. The locule is surrounded by abundant aerenchyma, which presumably allows the samara to float, and contains a seed much larger (ca. $1.5\text{--}2 \times 1\text{--}1.5$ cm) and thus heavier than in wind-dispersed species. In *H. platyptera* (Fig. 1) the elongate wing is retained, whereas in *H. leona* (Figs. 2, 3) the samara is flabellate and roughly as long as wide, somewhat similar to the samaras of *H. orinocensis* (H. B. K.) Adr. Juss., a riverine species common in the Orinoco and Amazon basins. As in many wing-fruited species of Malpighiaceae that have become adapted to water dispersal, the wing is variable in size and shape, and particularly

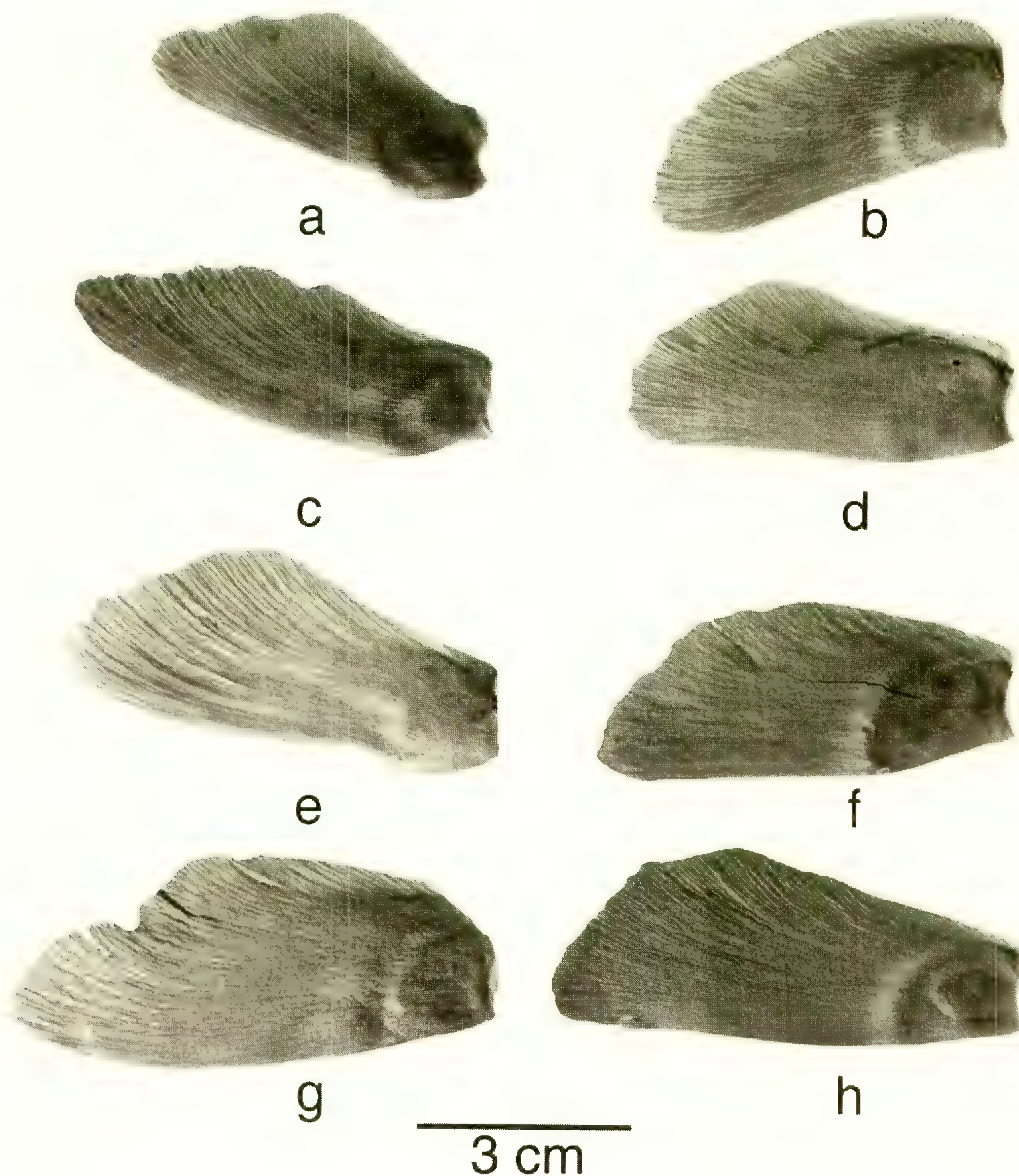


FIG. 1. Samaras of *Heteropterys platyptera* from the Lesser Antilles. a. St. Lucia (*Sturrock* 530, A). b. Martinique (*Stehlé & Stehlé* 4802, US). c. Guadeloupe (*Questel* 5047, US). d. Martinique (*Stehlé & Stehlé* 6444, US). e. St. Vincent (*Smith & Smith* 1549, US). f. Dominica (*Hodge* 551, GH). g. Dominica (*Fishlock* 23a, NY). h. Dominica (*Hill* 25747, NY).

so in *H. leona*. In that species the samara may be nearly semicircular in outline, or the wing may extend well below the nut or even nearly encircle it; the wing is usually somewhat longer than wide but sometimes almost as wide as long.

In the New World, *H. leona* is widely distributed along the Atlantic Coast from Belize to northern Brazil (Pará), but also in Pacific Colombia (Chocó, Valle). Niedenzu (1903, 1928) also reported it (as *H. reticulata*) from the Brazilian state of Amazonas, but the collection cited (*Poeppig* 2645, G!) proved to be *H. prancei* W. R. Anderson (W. R. Anderson, pers. comm.). *Heteropterys leona* occurs on Trinidad and has been recorded three times from Jamaica, where it is rare (Adams 1972).

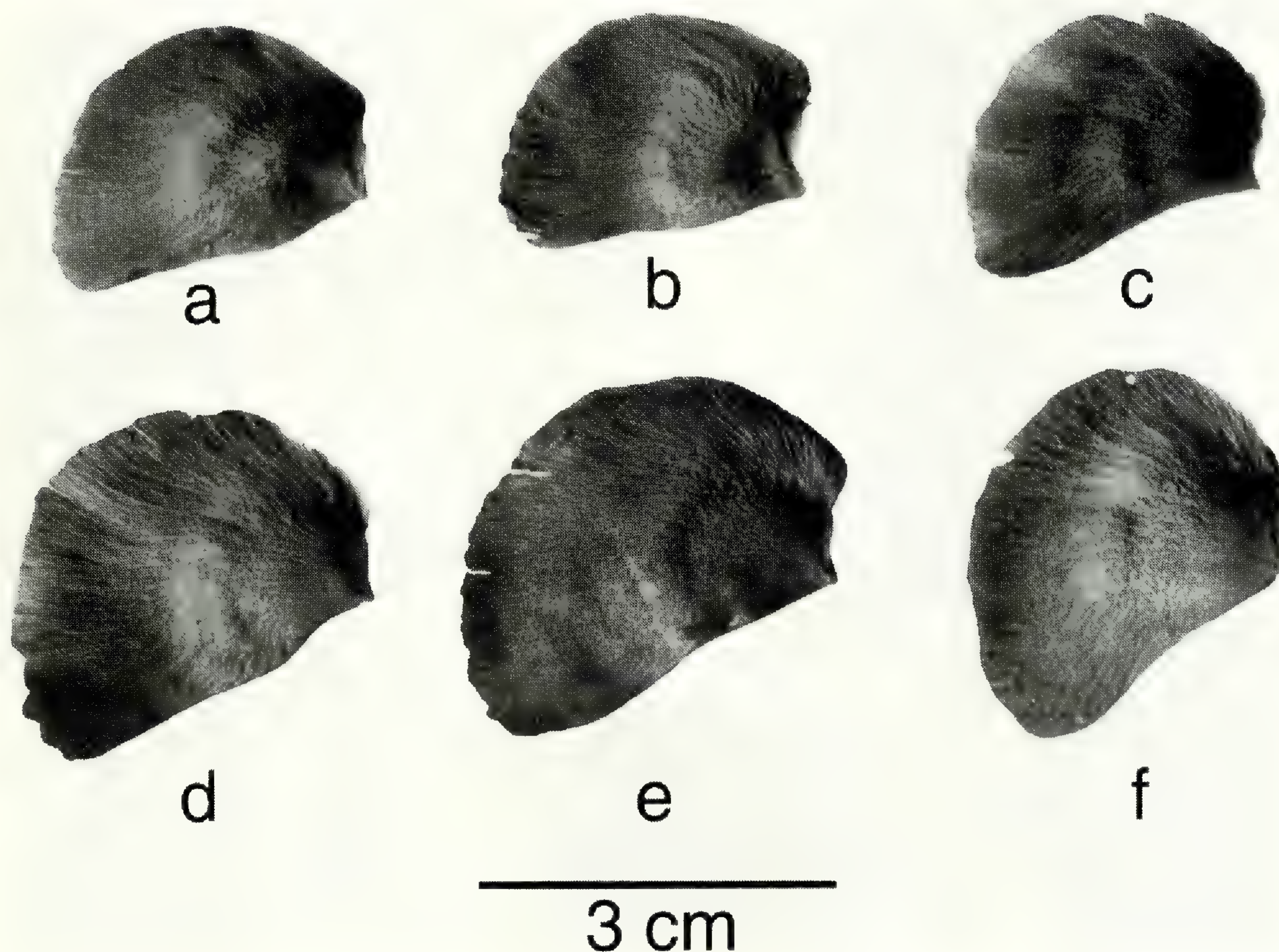


FIG. 2. Samaras of *Heteropterys leona* from Africa. a. Liberia (Adam 21349, MO). b. Equatorial Guinea (Carvalho 3425, MO). c. Gabon (Reitsma 2467, NY). d. Nigeria (Okafor & Latilo FHI57277, MO). e. Cameroon (Zenker 1107, MO). f. Cameroon (Thomas 2159, MO).

Although most collections are from coastal areas, *H. leona* has on occasion also been found inland (e.g., in Guyana near Dadanawa on the Rupununi River, *de la Cruz* 1414, 1462). In West Africa, it occurs in coastal regions from Senegal to Angola. A similar disjunction is also known for *Stigmaphyllon bannisterioides* (L.) C. Anderson [synonyms: *Stigmaphyllon ovatum* (Cav.) Nied.; *Brachypterys ovata* (Cav.) Small], a species of seashores, beaches, mangrove swamps, and salt marshes (C. Anderson 1997). In the New World *S. bannisterioides* occurs along the Atlantic Coast from southern Mexico (Veracruz) to northern Brazil (Maranhão) and in the West Indies, in the Old World in coastal areas of Guinea Bissau, Guinea, and Sierra Leone.

The populations of *H. leona* show quantitative differences in size of leaves and aspects of floral structure but few qualitative differences; none are correlated with geographic range. The variation is greater among the American populations than the African ones, but no characters separate the African specimens from the American ones, and they cannot be maintained as separate species. Differences include the nature of the abaxial epidermis, shape of petals, presence/absence of anther pubescence, presence/absence of a dorsal claw at style apex, and size and shape of samara. Also, the flowers vary somewhat in size, but all the parts then vary proportionally. The cells of the abaxial epidermis may be somewhat convex, giving a blistered appearance, or extended into prominent papillae to 0.03 mm long and easily discerned at low magnification. The papillate condition may lend a whitish sheen to the leaf surface, which was already noted by Jussieu (1843). All

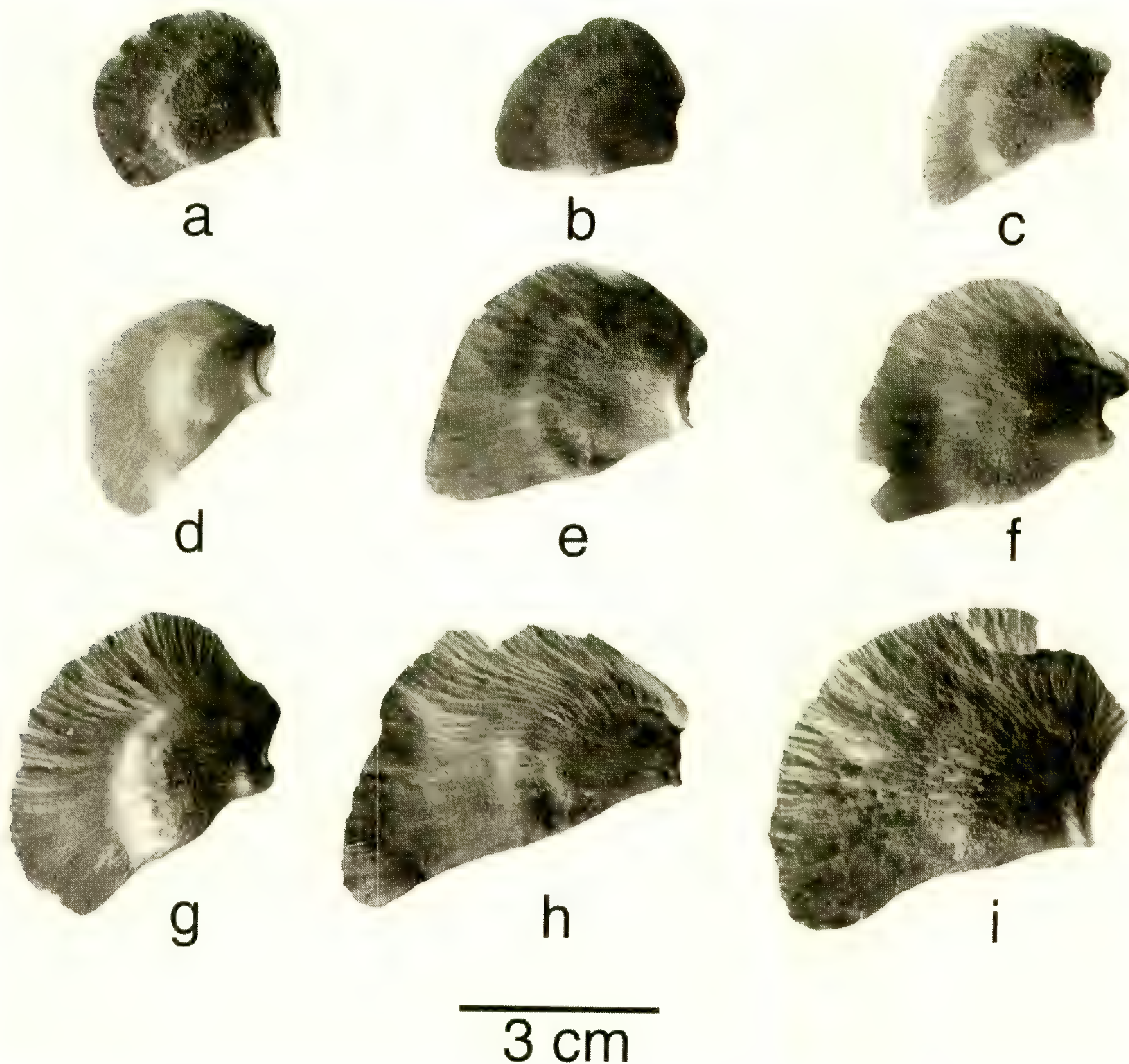


FIG. 3. Samaras of *Heteropterys leona* from the New World. a. Brazil (*Maguire et al.* 47120, NY). b. French Guiana (*Cremers & Hoff* 11239, US). c. Nicaragua (*Moreno & Sandino* 12141, MO). d. Honduras (*Vargas et al.* 355, NY). e. Guyana (*Gillespie* 1203, MICH). f. Colombia (*Albert de Escobar* 3245, NY). g. Jamaica (*Britton* 1484, NY). h. Colombia (*Cuatrecasas* 15936, US). i. Guyana (*Fan-shawe* 531, NY).

specimens seen from Africa, Venezuela (and Trinidad), and French Guiana have the leaves abaxially papillate. Those from Central America, Colombia, and Suriname are either papillate or blistered. None of the collections seen from Jamaica, Guyana, and Brazil are papillate. The limb of the petals varies from broadly triangular to orbicular; in specimens from Central America and Brazil only orbicular limbs are present, but the condition is so variable elsewhere that the absence of the triangular shape may only indicate an inadequate sample. The anthers are glabrous in all African specimens examined. They commonly bear apical and basal tufts of hairs in plants from the New World, but the hairs may also be very few (and then difficult to see) or absent. The styles bear the stigma on the apex at the adaxial angle, a placement traditionally called an "internal" stigma. The apex is drawn out abaxially into a dorsiventrally flattened claw (up to 0.6 mm long) but sometimes only into a spur as short as 0.1 mm. In African specimens, the stylar claws measure (0.1–) 0.2–0.4 mm long. In the American samples, the claws in general are ca. 0.2–0.3 mm long and in larger flowers reach 0.4–0.6 mm, but

flowers with styles extended only into a short spur occur occasionally. The longest claws (0.55–0.6 mm) were seen in flowers from the Guianas and Brazil, whereas in samples from Central America the claws did not exceed 0.3 mm.

As already noted above, there is much variation in the size and shape of the samara's wing in *H. leona*, but the greater diversity is found in the New World (compare Fig. 2 with Fig. 3). When contrasting samaras, care must be taken to assure that they are mature or nearly so. From fruiting specimens in various stages of maturity, it is evident that the wing increases first in length. Thus, young samaras of *H. leona* show an elongated wing, whereas the mature ones exhibit the flabellate condition. Samaras from African material are generally small and semi-circular (ca. $3\text{--}3.5 \times 2\text{--}2.5$ cm; Fig. 2) and are comparable to those seen from Central America, French Guiana, and Brazil (Fig. 3a–d). None of the collections seen from Costa Rica and Panama have mature samaras; immature samaras have the wing somewhat longer than wide, but again this may only indicate that the wing is not fully expanded, as in fruiting collections from other areas. The larger samaras (up to ca. 6×4 cm) with a more elaborate wing are found only in the New World (Fig. 3e–i). The samara of the fruiting collection from Jamaica (Fig. 3g) is most similar to those from Guyana (Fig. 3e, i); however, no fruiting collections from Venezuela and Trinidad were available for study.

The plants from Africa, the American mainland, Jamaica, and Trinidad are here recognized as representatives of one somewhat variable species, *H. leona*. Specimens from the Lesser Antilles differ in two distinct characters and one subtler aspect, and are here retained as a separate species, *H. platyptera*. The samaras of *H. platyptera* (Fig. 1) have a large elongated wing, always more than twice as long as wide (ca. $6\text{--}7 \times 2.5\text{--}3$ cm). In addition, the bracts are eglandular; in *H. leona* the bracts bear 1–5 minute glands on each margin. *Heteropterys platyptera* also differs in the apical ornamentation of the styles. Commonly the anterior style is dorsally rounded or bears a very short spur (0.05–0.1 mm), whereas the posterior styles lack an apical spur. Sometimes all styles are apically dorsally rounded, and sometimes all are spurred. Very rarely is the spur up to 0.2 mm long. *Heteropterys platyptera* and *H. leona* grow in similar wet habitats, but *H. platyptera* has not been reported from mangroves.

Nieden zu (1928) cited a record from Puerto Rico for *H. longifolia* var. *borealis* [= *H. platyptera*] based on a specimen by an unknown collector in the Ventenat Herbarium (G!); this collection is *H. leona*. Although it is possible that it represents a rare introduction, it is much more likely that the locality is in error. Aside from determinations by Adrien de Jussieu, the label bears only the words "Porto Rico" and "herb. Ventenat" by an unknown hand. No other Puerto Rican collections of this showy species are known, nor is it listed in floristic accounts of the island (e.g., Urban 1905–1911; Stahl 1936; Liogier & Martorell 1982).

CHROMOSOME NUMBER

Only one chromosome report has been published for the complex here examined, a count of $2n=20$ from root tips of unvouchered African material (Mangenot & Mangenot 1962). W. R. Anderson (1993) noted that subfamily Malpighioideae, which includes *Heteropterys*, is characterized by chromosome numbers based on $n=10$; his reports in the same article of counts in other species of *Heteropterys* are all $n=10$.

NOMENCLATURE AND TYPIFICATION

Owing to a tortuous taxonomic and nomenclatural history, a diversity of names has been applied throughout the floristic literature to the two species here discussed. Jussieu (1840, 1843) recognized the African component of *H. leona* as his *H. africana* and all American collections as *H. platyptera*. Niedenzu (1903, 1928) also used the name *H. africana* but recognized two New World species; he referred the Central and South American specimens to *H. reticulata* and the Lesser Antillean material to *H. longifolia*. Later authors, aware that *H. africana*, *H. reticulata*, and *H. longifolia* are illegitimate names, applied the names *H. leona*, *H. multiflora*, and *H. platyptera*, respectively. Additional synonyms, which did not gain widespread use, are listed below in the synonymies for each species.

The earliest name for the species here recognized as *H. leona* is *Banisteria leona*, published by Cavanilles in 1790. Cavanilles cited a Smeathman gathering in Thouin's herbarium and unspecified American collections in the Jussieu herbarium. The Smeathman sheet consists of a flowering shoot of *H. leona*, a fragment apparently taken from a Smeathman specimen at BM, and a mounted packet containing samaras of *Acridocarpus* Guill. & Perr. The flowering branch has associated with it a strip of paper bearing "Banisteria leona. Cav. Diss." in Cavanilles's hand and is here designated the lectotype. This Smeathman sheet is now at MPU; Peter A. Schäfer, Conservateur des Herbiers, generously provided detailed information about the discordant elements and the annotations associated with them.

Candolle (1824), in the treatment of the Malpighiaceae for his *Prodromus*, recognized that Cavanilles's name applied to a mixed gathering and restricted the name *Banisteria leona* to the flowering material of the Smeathman collection by excluding the samaras. Adrien de Jussieu (1843), the first monographer of the Malpighiaceae, moved *Banisteria leona* from the diverse assemblage that constituted the genus *Banisteria* into *Heteropterys*; however, he applied his own and superfluous name *Heteropterys africana*. He, too, excluded the fruits on the Smeathman sheet from the type of *Heteropterys africana* [= *Banisteria leona*]; these samaras constitute the holotype of *Acridocarpus cavanillesii* Adr. Juss. Both parts of the Smeathman collection bear Jussieu's annotations: attached to the flowering shoot a strip of paper with "Heteropterys africana. Ad. Juss." and on the packet his inscription "Acridocarpus Cavanillesii. Ad. Juss." Hooker (1849) published an additional name, *Heteropterys jussieui*, based on Don and Vogel specimens with larger-winged samaras than what Hooker considered typical for "*H. africana*," though these proved to be encompassed by the morphological variation of *H. leona*. Later authors, including Niedenzu (1903, 1912, 1928), followed Jussieu until Exell (1944) published the combination *Heteropterys leona*, the correct name for the species in *Heteropterys*.

Poiret (1816) published the earliest name for the American mainland element, *Malpighia reticulata*, for a Martin collection from Cayenne. Candolle did not see Poiret's type and in his *Prodromus* (1824) mistakenly assigned it to *Byrsonima*. As already noted, he, too, limited *Banisteria leona* to African material; he assigned the American representatives to his new species *Banisteria multiflora*, based on a Patris specimen, also from Cayenne, but noted the great similarity to *B. leona* ("valde accedit B. leonam"). Niedenzu (1903) corrected Candolle by publishing the combination *Heteropterys reticulata*, but that name was already occupied by the earlier *Heteropterys reticulata* Griseb. (1858). Hochreutiner (1910) used the next available epithet and formed the combination *Heteropterys multiflora*.

The names *H. reticulata* and *H. multiflora* are found throughout the floristic literature for the American representatives of *H. leona* and here are considered synonyms of *H. leona*.

Swartz published *Banisteria longifolia*, the earliest name for the Lesser Antillean species, with a brief diagnosis in his *Prodromus* (1788). He provided a more detailed description in volume 1 of his *Flora Indiae occidentalis* (1797), in which he noted that he saw only fruits but no floral parts, except the calyx. Types of names published by Swartz are often not readily traced, and original material for *B. longifolia* had been not been located until now. Niedenzu (1903) cited an Isert collection of 1787 from Martinique (C!) as probable type material ("*Banisteria longifolia*, specimen originarium, ut videtur"), but this is a flowering specimen, and there is no evidence that Swartz saw it. The Swartz Herbarium at S includes two sheets of a Swartz gathering from Guadeloupe that constitute the type collection. One sheet, here designated the lectotype, consists of a branch bearing two leaves and several inflorescences in immature fruit. On the back the sheet is annotated at the top in pencil by Swartz as "*Banisteria longifolia*. Guadel."; Swartz's note was partially overwritten in ink by Casstroem, who also repeated the same information at the base of the sheet. A second sheet at S bears fragments of this collection, a partial leaf and, in a mounted packet, pieces of the inflorescence; this sheet also has Swartz's penciled annotation "*Banisteria longifolia*" (attested by Wikstroem's note "Swartz scripsit"). Roger Lundin, Curator of the Regnellian Herbarium, kindly searched for this collection, and provided interpretation and attribution of the handwritings.

Persoon (1805) also published a name for the Lesser Antillean species, *Banisteria macrocarpa*, based on a Terrason specimen from Martinique in the Jussieu herbarium. In his *Prodromus* Candolle (1824) described a fruiting specimen from Guadeloupe as *Heteropterys platyptera*, unaware that the earlier names *Banisteria longifolia* Sw. and *Banisteria macrocarpa* Pers. applied to his new species. Jussieu (1843) recognized the synonymy but chose to use Candolle's name, the earliest in *Heteropterys*. It should be noted that Jussieu considered *Banisteria multiflora* DC. a synonym of *H. platyptera*; since these names were published simultaneously, Jussieu's choice must be followed. Niedenzu (1903) made the combination *Heteropterys longifolia* but again created a later homonym, for *Heteropterys longifolia* H. B. K. (1822). He should have proposed a combination based on Persoon's name, but that is now occupied by *Heteropterys macrocarpa* (Nied.) Kralik (1908). The earliest legitimate name for the Lesser Antillean species in *Heteropterys* is *Heteropterys platyptera*.

TAXONOMY

Heteropterys leona (Cav.) Exell, Cat. S. Tomé 123. 1944. *Banisteria leona* Cav., Diss. 9: 424. 1790. *Heteropterys africana* Adr. Juss., Ann. Sci. Nat. Bot., sér. 2, 13: 276. 1840, nomen superfl. *Heteropterys africana* var. *borealis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 55. 1903, nomen superfl. *Heteropterys africana* var. *borealis* f. *nigritiana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 55. 1903, nomen superfl.—TYPE: SIERRA LEONE, *Smeathman s.n.*, the flowering branch only (lectotype, here designated: MPU; isolectotype: BM!). [The samaras contained in the packet on the sheet at MPU constitute the holotype of *Acridocarpus cavanillesii* Adr. Juss.]

Malpighia reticulata Poir., Encycl. méth. Bot. Suppl. 4: 8. 1816. *Byrsonima reticulata* (Poir.) DC., Prodr. 1: 581. 1824, non *Byrsonima reticulata* Griseb., 1849. *Heteropterys reticulata* (Poir.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 54. 1903, non *Heteropterys reticulata* Griseb. in Mart., 1858. *Banisteria reticulata* (Poir.) C. B. Rob. in Small, N. Amer. Fl. 25(2): 138. 1910.—TYPE: FRENCH GUIANA. Cayenne, *Martin s.n.* (holotype: FI, photo: MICH!; isotype: P-JU 11628+B, photo and microfiche: MICH!).

Banisteria multiflora DC., Prodr. 1: 589. 1824, non *Banisteria multiflora* Adr. Juss., 1840. *Heteropterys multiflora* (DC.) Hochr., Bull. New York. Bot. Gard. 6: 277. 1910.—TYPE: FRENCH GUIANA. Cayenne, *Patris s.n.* (holotype: G-DC, photos: GH! MICH!, microfiche: MICH!; isotype: G!).

Banisteria magnoliifolia Desv. ex Hamilton, Prodr. Ind. occ. 40. 1825.—TYPE: “Herb. Prof. Desv. Guyana” (holotype: not located).

Heteropterys jussieui Hook. f., Niger Flora 246. 1849.—TYPE: SIERRA LEONE, *Don s.n.* (lectotype, here designated: BM!, fragment of lectotype: K!).

Heteropterys africana var. *borealis* f. *senegalensis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 55. 1903.—TYPE: [GUINEA]. “Senegambie. Croit dans les partis supérieurs du rio Nuñez et du rio Pongos,” *Heudelot* 892 (holotype: B, destroyed; isotypes: G! K! P-JU; microfiche of P-JU isotype: MICH!).

Heteropterys africana var. *australis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 55. 1903.—TYPE: CAMEROON. Bipindi, 1896, *Zenker* 1107 (lectotype, here designated: MO!; isoelectotypes: G! K!).

Figs. 2, 3.

Liana, scandent or climbing shrub to 10 m, sometimes a shrub to 6 m, or rarely a small tree. Lamina of the larger leaves 10–37.5 cm long, 3.5–19.7 cm wide, coriaceous, oblong, elliptical, lanceolate, ovate, or oblanceolate, apex short- to long-acuminate or rarely caudate, base rounded to subcordate, adaxially sparsely sericeous when young, soon glabrous or with a few hairs retained on and near the costa, abaxially sparsely sericeous or sometimes glabrate or rarely glabrous, the hairs 0.1–0.3 (–0.5) mm long, the abaxial epidermis minutely blistered or papillate (always papillate in African specimens), the papillae up to 0.03 mm long, with scattered small impressed glands near the margin abaxially; petioles 0.5–1.8 cm long; stipules minute and caducous, 0.2–0.3 mm long, or absent (?). Inflorescence a panicle of pseudoracemes (5–) 6–18 (–30) cm long, usually only 2 (or sometimes 4) opposing flowers of a pseudoraceme fully open at one time. During anthesis peduncles 1.5–5 (–6) mm long, pedicels (1–) 2–6.5 mm long, peduncles (0.3–) 0.5–1.4 (–2) times as long as pedicels; peduncles and pedicels thickening/elongating as the fruits mature. Bracts 3–9 mm long, 1.5–4 (–5) mm wide, narrowly elliptical, elliptical, lanceolate, or ovate, with 1–5 tiny glands along each margin; bracteoles 2.3–5 (–6.5) mm long, 1.5–2.5 (–3.5) mm wide, elliptical to sometimes suborbicular, eglandular. Calyx of 4 biglandular lateral sepals and 1 eglandular anterior sepal; sepals 2.5–4 mm long, recurved to revolute, the lateral ones exceeding the glands by ca. 1 mm. Petals 5, yellow or pale yellow, the limbs triangular to triangular-orbicular to orbicular with the margin erose or erose-fimbriate and the base truncate or sometimes cordate; posterior petal: claw 2.7–3.5 (–4.5) mm long, limb 3.5–4.5 (–6.5) mm long, 3.5–4.5 (–5.5) mm wide; lateral petals: claw 2.2–3 (–4) mm long, limb 4–6 (–7) mm long, 4–6.5 (–7) mm wide. Filaments (2–) 2.5–4.5 mm long,

unequal, those opposite the posterior petal and the anterior-lateral petals usually the shortest, anthers 0.8–1.1 mm long, with apical and basal tufts of hairs or the hairs very sparse, sometimes glabrous (always glabrous in African specimens). Anterior style (2.3–) 2.6–4.5 (–5.2) mm long, posterior styles 2.6–5 (–5.5) mm long, all with the apex dorsally extended, commonly with a dorsiventrally flattened claw (0.1–) 0.3–0.5 (–0.6) mm long or sometimes only spurred. Samaras 3–6 cm long, 2–4 cm wide, ca. 1–1.5 times as long as wide, with a flabellate dorsal wing, the wing extending or not below the nut, the locule embedded in aerenchyma; embryo 1.3–2.3 cm long, 1–1.5 cm wide, ovoid, the cotyledons straight or rarely slightly folded. Chromosome number: $2n = 20$ (Mangenot & Mangenot 1962).

Phenology. Collected in flower and fruit throughout the year.

Distribution. In the Old World in coastal West Africa, from Senegal to Angola; in the New World mostly in the Atlantic coastal regions from Belize to northernmost Brazil (Amapá, Pará), or sometimes also farther inland, also in Colombia (Chocó, Valle); rare in Jamaica (3 records); one doubtful report from Puerto Rico; in riverine vegetation, swamps, wet and flooded forest, rainforest, wet areas of beaches, mangroves, and at edges of lagoons; sea level to 200 (–450) m.

REPRESENTATIVE SPECIMENS. **Senegal.** Basse-Casamance, Etomé, *Vanden Berghen* 7831 (MO). **Guinea.** Timbo, *Boué* 71 (G, NY). **São Tomé e Príncipe.** Porto Alegre, *Chevalier* 14197 (K). **Sierra Leone.** Near Njala, *Deighton* 1753 (BM, K, MO); Boujema near Njala, *Deighton* 4635 (K); Goderich, *Deighton* 4752 (K); Waterloo, *Lane-Poole* 266 (K). **Liberia.** Robertsfield, *Adam* 21349 (MO); Sino Co., Greenville, *Baldwin* 11556 (K, MO, NY); 3 mi NE of Suacoco, Gbarnga, *Daniel & Barker* 209 (MO); near Haindi, 40 km N of Kakata, *Leeuwenberg & Voorhoeve* 4972 (K, MO); Monrovia, *Massey* 77 (NY). **Ivory Coast.** Along Ebrie Lagoon near ORSTOM, W of Abidjan, *de Wilde* 624b (K); Adiopodoumé, 05°20'N, 04°09'W, *Geerling & Bokdam* 337 (MO); near Canal d'Assini, E of Grand Bassam, *Oldeman* 148 (K, MO); near Bonoua, 15 km NE of Grand Bassam, *Versteegh & de Outer* 634 (MO). **Ghana.** Asuboni River, near Ankoma, *Hall & Agyakwa* GC39670 (MO); Princes, *Akpabla* 7798 (K). **Nigeria.** CROSS RIVER: Oban Dist., *Talbot & Talbot s.n.* (BM, K).—LAGOS: swamp forest S of Lagos University campus, *Hossain* 1441 (MO); Lagos, *Miller* 160 (K).—ONDO: Dist. Ondo, Agbabu, *Okafor & Latilo* FHI57277 (K, MO).—RIVERS: Dist. Nembe, between Nembe and Brass, *Gbile & Daramola* 54/80 (MO). **Cameroon.** Littoral province, Wouri district, Dibamba River bridge on road from Douala to Yaoundé, 03°59.98'N, 09°50.68'E, *Davis* 99-5 (MICH); bank of Nyong River, ca. 65 km SSW of Eséka, *de Wilde* 2746b (K, MO); right bank of Lobé River, 8 km S of Kribi, *Leeuwenberg* 5562 (MO); 22 km SW of Douala, right bank of Dibamba River, *Leeuwenberg* 6447 (K, MO); Buea-Douala, bank of Mana (Ndian) River, 04°55'N, 08°50'E, *Thomas* 2159 (MO); Dept. Fako, Bakingili, 04°04'N, 09°02'E, *Thompson* 1329 (K, MICH, MO, NY). **Equatorial Guinea.** Bioco, Malabo–Luba, Km 33, camino del patio María Isabel, *Carvalho* 2986 (K, MO); Bioco, Ela Nguema, barrio de Santa Cruz, *Carvalho* 3425 (K, MO), 3415 (BM, G). **Gabon.** Moka Creek, E of Mondah river, 00°39'N, 09°28'E, *Bos et al.* 10809 (K, MO); environs de Egolani, sur le lac Oghémoné, *Chevalier* 26456 (K); Libreville, *Klaine* 3338 (K); Prov. Woleu-Ntem, descente sur le Ntem à partir de Evela, 02°03'N, 12°15'E, *Louis* 2906 (MO); Xalibé, 00°33'N, 09°22'E, *Reitsma* 2467 (NY); Lopé Reserve, Ogoove, 00°15'N, 11°40'E, *White* 1226 (MO). **Angola.** Sumba, Peco, *Gossweiler* 9120 (BM, K, US).

Puerto Rico. [?; doubtful record] unknown collector, Herb. Ventenat (G). **Jamaica.** ST. ELIZABETH: Lacovia and vicinity, border of Black River, *Britton* 1484 (NY); banks of Black River, Lacovia, *Harris* 9753 (BM, K, NY); Black River, Lacovia to Elam, *Harris* 9850 (BM, K). **Trinidad.** Pt. Coco near Irois, *Broadway* 8477 (K, NY).

Guatemala. IZABAL: near Puerto Barrios, *Standley* 73169 (US). **Belize.** TOLEDO: Rio Sarstoon, Belize-Guatemala border, 5 mi inland, *Dwyer* 14874 (MICH, MO); Rio Grande, *Gentle* 4681 (MICH, MO). **Honduras.** ATLÁNTIDA: Triunfo, near Tela, *Standley* 53779 (A, US).—COLÓN: Laguna Guaimoreto, 4.5 mi NE of Trujillo on old rd to Castilla, 15°57'30"N, 85°54'30"W, *Saunders* 916 (NY).—GRACIAS A DIOS: Barra Plátano, 15°53'N, 84°42'W, *Fryxell* 2836 (BM, MICH, NY); vicinity of Puerto Lempira, *Proctor* 38925 (BM); Klauban, W de Brus, *Vargas et al.* 355 (NY). **Nicaragua.** ZELAYA: Bluefields, *Long* 210 (F); Monkey Point, 11°36'N, 83°39'W, *Moreno & Sandino* 12141 (MO); between Lamblaya and Laguna Kauropura, *Vincelli* 673 (MICH). **Costa Rica.** LIMÓN: Cantón Talamanca, P. N. Cahuita, cerca de la Punta Cahuita, 09°44'N, 82°49'W, *Morales* 4936 (CR); Parque Tortuguero, 600 m al SE de

Tortuguero sobre el Río, 10°31'N, 83°30'W, *Robles 1430* (MICH, MO). **Panama.** BOCAS DEL TORO: Laguna de Chiriquí, Nuri, 15 km W de Punta Cricamola, 08°55'N, 81°49'W, *Foster 14633* (F); vicinity of Chiriquí Lagoon, Old Bank Island, *von Wedel 2027* (GH, MO, US).—SAN BLAS: trail to village of Cangandí, 09°24'N, 79°24'W, *de Nevers et al. 7427* (MICH, MO); along rd between Mandinga and Cangandí, *Duke 14724* (MO, US).

Colombia. CHOCÓ: along Río Truando between Riosucio and Esperanza, *Duke 9132* (NY); hoyá del Río San Juan, Río Fujiadó, afluyente del Río San Juan, 04°36'N, 76°54'W, *Forero et al. 4794* (MO); area of Baudó, ca. 13 km upstream from estuary, *Fuchs & Zanella 21748* (G, MO, NY); Mpio. Quibdó, carretera Quibdó–Yuto, Río Cabi, *García Cossio 70* (MO); Río El Salto, tributary of Río Suruco, 9 km W of Andagoya, *Lellinger & de la Sota 440* (US); Istmo de San Pablo, *Triana 388* (G, K, NY).—VALLE: Mpio. Buenaventura, Corr. Bocas del Tigre, quebrada Mondoyá, *Cuadros V. 943* (MO); Río Yurumanguí, *Cuatrecasas 15899, 15936* (US). **Venezuela.** DELTA AMACURO: Winiquina, *Gines 5011, 1015* (NY); Río Cuyubini, upstream from Casa Cuyubini, *Steyermark 87498* (MICH, MO, NY, US); Depto. Antonia Díaz, Caño Joba–Suburu, W of Caño Guayo and E of Caño Sacupana, 09°00'W, 61°00'W, *Steyermark et al. 115137* (MICH, MO). **Guyana.** Mt. Everard, *de la Cruz 1327* (NY, US); Upper Rupununi River, near Dadanawa, 02°45'N, *de la Cruz 1414, 1462* (MO, NY, US); vicinity of Wismar, Demerara River, 06°N, *de la Cruz 2422* (MO, NY); Kaieteur Falls, Potaro River, *de la Cruz 4491* (MO, NY, US); Mabura Hill area, just before bridge to base camp at Ekuk, *Ek & Nathan 1140* (MICH); Kamuni Creek, Groete Creek, Essequibo River, *Fanshawe 531* (NY); Pomer- roon-Supenaam Region, Pomer- roon River between Charity and Araplako River, 07°23'N, 58°36'W, *Gillespie 1203* (MICH, US); vicinity of Kartabo Station, junction of Mazaruni and Cuyuni Rivers, *Graham 272* (NY, US); Region Upper Demerara-Berbice, Essequibo River, 2–4 km from Bartica, 06°25'N, 58°35'W, *Henkel 1747* (MICH, US); Region Essequibo Islands-West Demerara, Groete River, *Henkel 2757* (MICH, NY, US); Region Barina-Waini, Upper Sebai River, 8 km from Sebai village, 07°51'N, 59°17'W, *Hoffman 660* (MICH, NY, US). **Suriname.** Without locality, *Hostmann 531, 895, 1030* (K); vicinity of Paramaribo, *Kramer & Hekking 2540* (NY); along Kabo Creek, Tibiti savanne, *Lanjouw & Lindeman 1917* (K, NY); along bank of Wayombo River, *Lindeman 6261* (US); Wilhelmina Gebergte, Zuid River, between Kayser airstrip and confluence of Lucie River, *Maguire et al. 54020* (NY, US). **French Guiana.** Vicinity of Cayenne, *Broadway 937* (K, NY); Crique Iracoumpapy, *Cremers & Hoff 11239* (US); route de Saint Elie avant d'arriver au village, *de Granville B.5121* (MICH); Km 19, piste de St. Elie, *Prévost 588* (MICH, NY); Mana, *Mélinon 57* (MICH); Karouany, *Sagot 93* (G, K); Godebert, *Wachenheim 120* (K, US). **Brazil.** AMAPÁ: Rio Oiapoque, near Santo Antonio, 03°53'N, 51°48'W, *Maguire et al. 47120* (K, NY, US).—PARÁ: north woods of I.A.N., Belém, *Archer 8305* (NY); Rio Guamá, *Frões 20434* (K); estrada Belém–Mosqueiro, *Silva 59708* (K, MICH, NY, US); Ilha do Marajó, Rio Anajás, ca. 2 km downstream from the city of Anajás, *Sobel et al. 4795* (K, MICH, NY).

Heteropterys platyptera DC., Prodr. 1: 592. 1824.—TYPE: GUADELOUPE, *Krauss s.n.* (holotype: G-DC, photo and microfiche: MICH!).

Banisteria longifolia Sw., Prodr. 75. 1788. *Heteropterys longifolia* (Sw.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 53. 1903, non *Heteropterys longifolia* H. B. K., 1822 [“1821”]. *Heteropterys longifolia* var. *martinicensis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 54. 1903, nom. superfl. *Heteropterys platyptera* var. *martinicensis* (Nied.) J. F. Macbride, Candollea 6: 12. 1934, nom. superfl.—TYPE: GUADELOUPE. *Swartz s.n.* (lectotype, here designated: S, the sheet bearing the branchlet with leaves and inflorescences; isoelectotype: S, the sheet bearing a partial leaf and packet containing fragments of inflorescences; photocopies of lectotype and isoelectotype: MICH!).

Banisteria macrocarpa Pers., Syn. pl. 1: 507. 1805, non *Heteropterys macrocarpa* (Nied.) Kralik, 1908.—TYPE: MARTINIQUE, 1792, *Terrasson 31* (holotype: P-JU 11628+C, photo: A!, microfiche: MICH!).

Banisteria macradena β *guadalupensis* DC., Prodr. 1: 590. 1824.—TYPE: GUADELOUPE, *Bertero s.n.* (holotype: G-DC, photo and microfiche: MICH!).

Banisteria pubiflora DC., Prodr. 1: 591. 1824. *Heteropterys pubiflora* (DC.) Bello, Anales Soc. Esp. Hist. Nat. 10: 245. 1881.—TYPE: GUADELOUPE,

L'Herminier s.n. (lectotype, here designated: G-DC, photo and microfiche: MICH!).

Heteropterys longifolia var. *borealis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 53. 1903. *Heteropterys platyptera* var. *borealis* (Nied.) J. F. Macbride, Candollea 6: 12. 1934.—TYPE: DOMINICA. *Imray* 405 (lectotype, designated by W. R. Anderson, 1988: GH!).

Fig. 1.

Liana, scandent or climbing shrub to 10 m, sometimes a shrub to 5 m, or rarely a small tree. Lamina of the larger leaves 8–33 cm long, 3.5–15 cm wide, coriaceous, oblong, elliptical, lanceolate, or ovate, apex (long-) acuminate to caudate, base rounded to subcordate, adaxially sparsely sericeous when young, soon glabrous or with a few hairs retained on and near the costa, abaxially sparsely sericeous to glabrate or glabrous, the hairs 0.1–0.3 mm long, the abaxial epidermis minutely blistered but epapillate, with scattered small impressed glands near the margin abaxially; petioles 0.8–1.7 cm long; stipules minute and caducous, 0.2–0.3 mm long, or absent (?). Inflorescence a panicle of pseudoracemes (5–) 6–22 cm long, usually only 2 (or sometimes 4) opposing flowers of a pseudoraceme fully open at one time. During anthesis peduncles 1.5–4.6 (–6) mm long, pedicels 1.7–4.5 mm long, peduncles 0.6–1.2 (–2) times as long as pedicels; peduncles and pedicels thickening/elongating as the fruits mature. Bracts 3–4.5 mm long, 2–3 (–4) mm wide, narrowly elliptical to ovate, eglandular; bracteoles 2.4–3.8 (–5) mm long, 1.5–2.5 mm wide, elliptical to ovate, eglandular. Calyx of 4 biglandular lateral sepals and 1 eglandular anterior sepal; sepals 3–3.3 mm long, recurved to revolute, the lateral ones exceeding the glands by ca. 1 mm. Petals 5, yellow or pale yellow, the limbs triangular to triangular-orbicular with the margin erose or erose-fimbriate and the base truncate; claw of posterior petal 3–3.3 mm long, claw of lateral petals 2.5–3 mm long; limb of all petals 4–4.6 mm long, 4–4.8 mm wide. Filaments 2.2–3.5 mm long, unequal, those opposite the posterior petal and the anterior-lateral petals usually the shortest, anthers 0.8–1 mm long, mostly with apical and basal tufts of hairs, or the hairs very sparse or sometimes absent. Anterior style 2.6–3.2 mm long, posterior styles 3.1–3.5 mm long, all with the apex dorsally blunt or with a tiny spur up to 0.1 (–0.2) mm long. Samara with an elongate dorsal wing 5.8–7 cm long, 2.5–2.7 cm wide, 2.2–2.8 times as long as wide, never extending below the nut, the locule embedded in aerenchyma; embryo 1.4–1.8 cm long, 1–1.2 cm wide, ovoid, the cotyledons straight or rarely slightly folded. Chromosome number unknown.

Phenology. Collected in flower and fruit from December through August.

Distribution. Lesser Antilles (Guadeloupe, Dominica, Martinique, St. Lucia, and St. Vincent); mostly in wet and flooded areas: in rain forest, swamps, and along riverbanks, also in drier sites: in forests, woodlands, ravines, and disturbed areas; sea level to 400 (–580) m.

REPRESENTATIVE SPECIMENS. **Guadeloupe.** BASSE TERRE: Barè-Mahault, *Questel* 741 (MICH, US); Vernou, Grand Rivière, *Questel* 5047 (US); Sofaia, Rivière Salée, *Sastre* 2746 (A, MO); near Duclos, Petit Bourg, A. C. *Smith* 10358 (A, K, NY, US). **Dominica.** Between Point Lolo and Pont Cassé, NW of Moren Trois Pitons, *Ernst* 1289 (GH, MICH, US); W of Rosalie, ca. 1–2 mi on rd to Castle Bruce Junction and Pont Cassé, *Ernst* 1352 (US); without locality, *Fishlock* 23a (NY, US); old trail from Petite Savane to Point Mulatre, 15°15'N, 61°16'W, *Hill* 25747 (GH, NY); Sylvania Estate, *Hodge* 551 (GH, NY, US); Wet Area Experimental Station near D'Eau Gommier, *Nicolson* 4180 (BM, MICH, US). **Martinique.** Champ Flore area, *Howard & Howard* 18845 (A, BM, NY, US);

without locality, 1787, *Isert s.n.* (C); hauteurs du Diamant, *Stehlé & Stehlé* 4790 (US); plateau militaire, hauteurs de Case-Pilote, Bois de la Démarche, *Stehlé & Stehlé* 4802 (US); St. Joseph, Petite Rivière, *Stehlé & Stehlé* 6444 (US); Balata à Tivoli, *Stehlé & Stehlé* 6888 (MICH, US). **St. Lucia.** Anse la Raye, *Beard* 1055 (GH, MO, US); Le Toc to Cul de Sac Bay, *Howard* 11368 (A, BM, MICH, NY); between Quillesse and Morne Troumasse, *Howard* 11649 (A, BM, MICH, NY); Morne, *Sturrock* 530 (A). **St. Vincent.** Along Chateaubelaire River, *Morton* 5237 (BM, GH, US); without locality, *H. H. Smith & G. W. Smith* 1549 (BM, GH, K, NY, US).

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PEIXOTOA FLORIBUNDA (MALPIGHIACEAE), A NEW SPECIES FROM PARAGUAY

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ABSTRACT. A new species of *Peixotoa* (Malpighiaceae) from eastern Paraguay, *P. floribunda* C. Anderson, is described and illustrated.

Peixotoa Adr. Juss. (Malpighiaceae) is a genus of vines and shrubs characterized by distinctive, heart-shaped stipules; flowers with large, yellow, often fringed petals; and samaras with an elongate dorsal wing and two lateral winglets (Anderson 1982). Its range extends over much of Brazil south of the Amazon region and into adjacent Bolivia and Paraguay. The inflorescence units are 4-flowered umbels, which are usually arranged in compound dichasia or thyrses. In some species the secondary and tertiary inflorescence axes are suppressed at more distal nodes, such that the umbel is sessile in the leaf axil; the terminal node then bears 3 umbels and thus is 12-flowered. Recent collecting activity in eastern Paraguay yielded an additional species, here described, in which the inflorescence is so modified. The genus now comprises 29 species. Much of the range of *Peixotoa* is still only poorly known floristically, and more undescribed species may yet be discovered.

Peixotoa floribunda C. Anderson, sp. nov.—TYPE: PARAGUAY. Alto Paraguay: Parque Nacional Defensores del Chaco, Agua Dulce area, 19°58'49"S, 59°44'25"W, 14 Feb 1999, *Zardini & Godoy 50346* (holotype: MICH!; isotype: MO!). Fig. 1.

Frutex scandens. Stipulae 4–7 mm longae et latae, acutae, caducae. Petioli 3–8 mm longi, dense velutino-tomentosi. Laminae 6–11 cm longae, 4.5–7 cm latae, late ellipticae vel ovatae, supra velutinae, subtus tomentosae, basi juxta costam biglandulosae. Inflorescentia terminalis vel axillaris, ramis secundariis nodorum distaliorum multum redactis; umbellis 2 in nodis subterminalibus, umbellis 3 in nodis terminalibus, pedunculis secundariis ca. 2 mm longis vel absentibus. Bractee bracteolaeque praesentes. Pedicelli 9–12 mm longi. Limbus petalorum lateralium 9–10.5 mm longus, 8.5–9.5 mm latus, late obovatus vel suborbicularis, margine lacerato-glanduloso. Limbus petali postici ca. 5.5 mm longus, ca. 5 mm latus, late obovatus vel suborbicularis, margine dentato, glandulis capitatis ornato. Glandulae stamiodiorum apice et pagina abaxiali laeves. Styli subaequales, 3.5–3.7 mm longi, anticus parum inclinatus versus petalum posticum, postici divergentes. Samara ignota.

Scandent shrub ca. 1.5 m tall. Vegetative branches velutinous-tomentose when young, eventually becoming glabrous, the vesture of all structures white. Stem stipules 4–7 mm long and wide, cordate-triangular, entire, the apex acute, adaxially finely velutinous-tomentose in the distal 1/2–2/3 and in a band along the margin

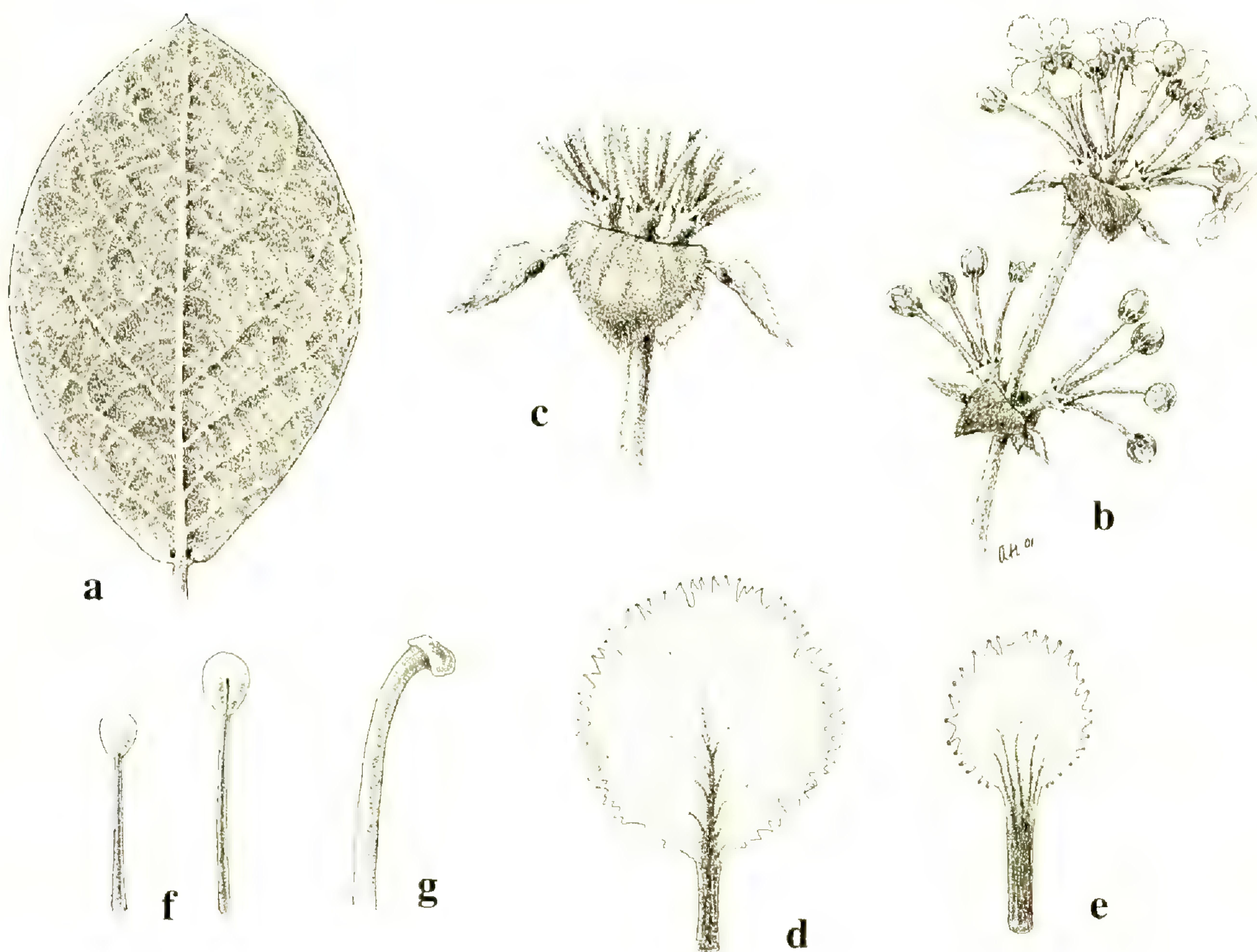


FIG. 1. *Peixotoa floribunda*. a. Stem leaf, abaxial view, $\times 0.5$. b. Flowering branch, $\times 1.5$. c. Base of a distal umbel with a pair of stipules and a pair of inflorescence leaves, $\times 3$. d. Lateral petal, $\times 3$. e. Posterior petal, the "flag," $\times 3$. f. Distal portions of posterior-lateral staminode (in abaxial view, left) and anterior staminode (in adaxial view, right), $\times 5$. g. Distal portion of anterior style, $\times 7.5$. (Based on Zardini & Godoy 50346.)

but otherwise glabrate to glabrous, abaxially densely velutinous-tomentose, caducous, inflorescence stipules like the cauline, eventually deciduous. Stem leaves with the petioles 3–8 mm long, densely velutinous-tomentose; laminas 6–11 cm long, 4.5–7 cm wide, broadly elliptical to ovate, apex acute, base narrowly truncate, adaxially velutinous, abaxially tomentose with the hairs mostly concentrated on the veins, a pair of sessile glands at the base at the costa or halfway on the petiole, each gland 0.8–1.6 mm in diameter. Inflorescence leaves with the petiole at least 1 mm long, laminas abruptly smaller than the cauline, the smallest at least 2.5 mm long, 0.8 mm wide, narrowly elliptical to narrowly triangular, apex acuminate to sometimes caudate, adaxially velutinous or sparsely so, abaxially densely velutinous-tomentose, a pair of glands at the base, each gland ca. 1 mm in diameter. Inflorescences terminal and axillary, at the proximal nodes with 2° axes present but 3° axes suppressed, at the more distal nodes both 2° and 3° axes suppressed and the umbels sessile or borne on secondary peduncles in the leaf axils, the terminal node always with 3 umbels; each umbel 4-flowered, primary peduncles absent, secondary peduncles up to 2 mm long or absent. Bracts 0.6–0.8 mm long, 0.4–0.6 mm wide, bracteoles 0.3–0.4 mm long, 0.2–0.3 mm wide, all triangular, essentially glabrous. Pedicels 9–12 mm long, densely velutinous-tomentose. Sepals 4.3–4.5 mm long, ca. 2 mm wide, adaxially the distal 1/2 tomentulose and otherwise glabrous, abaxially densely velutinous-tomentose, glands on the lateral sepals 1.8–2 mm long. Claw of the lateral petals 2–2.5 mm long, ca. 0.3 mm wide, limb 9–10.5

mm long, 8.5–9.5 mm wide, broadly obovate to suborbicular, margin lacerate-dentate, the teeth up to 1 mm long, gland-tipped. Claw of the posterior petal ca. 4 mm long, ca. 0.5 mm wide, limb ca. 5.5 mm long, ca. 5 mm wide, broadly obovate to suborbicular, margin dentate, the teeth up to 0.7 (–1) mm long, capitate-glandular. Androecium of 5 stamens opposing the petals alternating with 5 staminodes opposing the sepals. Lateral stamens subequal, filaments 3.9–4.1 mm long, glandular connective ca. 0.6 mm long; posterior stamen filament ca. 2.4 mm long, arced toward the posterior petal, anther ca. 1 mm long, glandular connective ca. 0.6 mm long. Staminodes unequal; anterior filament ca. 4 mm long, exceeding the anterior-lateral two, anterior-lateral filaments ca. 3.5 mm long, exceeding the posterior-lateral two, posterior-lateral filaments ca. 3 mm long, inflexed between the posterior styles, anterior and anterior-lateral staminode glands ca. 1.1 mm long, posterior-lateral glands ca. 0.8 mm long, all glands with the apex and abaxial face smooth. Anterior and posterior styles subequal, 3.5–3.7 mm long, ca. 0.4 mm in diameter, anterior style slightly arced toward the posterior petal, posterior styles divergent, distally slightly curved inward; stigmas ca. 0.4 mm in diameter, terminal and slightly wider than the style apex. Mature fruits not seen; immature samaras with the lateral wings ca. 12 mm long, ca. 7 mm wide (probably fully developed), the dorsal wing not fully developed, ca. 2 cm long, ca. 1 cm wide.

Peixotoa floribunda is known only from the type and a second gathering (Zardini & Godoy 50345, MICH! MO!) collected at the same time and place in eastern Paraguay. Its range may well extend into Brazil. The large attractive flowers arrayed in elaborate inflorescences should draw the attention of future collectors in this region of South America. The type is of flowering material; the paratype has immature fruits. It is noteworthy that the anterior sepal of flowers of the type bear one gland (ca. 1.6 mm long), smaller than those on the lateral petals; the anterior sepal is eglandular in the paratype. Such occasional expression of sepal glands on the anterior sepal occurs in other species of *Peixotoa* as well as other genera of Malpighiaceae that normally have the anterior sepal eglandular.

The specialized inflorescence with suppressed secondary and tertiary branches distinguishes *P. floribunda* from the only other species of *Peixotoa* known from Paraguay, the common and widespread *P. reticulata*, an apomict notable for its indehiscent anthers containing aborted pollen. Two species, in addition to *P. reticulata*, occur in southwestern-most Brazil and southeastern-most Bolivia: *P. magnifica* C. Anderson and *P. cordistipula* Adr. Juss.; both have an unmodified inflorescence.

Other species with suppressed secondary and tertiary inflorescence branches and thus 12 flowers (3 umbels) instead of 4 flowers (1 umbel) at the terminal nodes are limited to eastern and central Brazil. They may be separated with the key provided below. In *P. andersonii*, an unusual species known from a single collection from the area of Diamantina in Minas Gerais, both the generalized and the specialized inflorescence structures are expressed.

KEY TO THE SPECIES OF PEIXOTOA WITH 12 FLOWERS AT THE TERMINAL INFLORESCENCE NODES

1. Leaf glands borne on the abaxial surface of the lamina, above the base and away from the petiole and costa.
 2. Leaf glands stalked, 0.8–1.5 mm in diameter; laminae abaxially golden-sericeous; Bahia.
P. adenopoda C. Anderson.
 2. Leaf glands sessile, 0.2–0.7 mm in diameter; laminae abaxially with T-shaped hairs to loosely tomentose; coastal Santa Catarina.
P. catarinensis C. Anderson.

1. Leaf glands borne at the abaxial base of the lamina at the insertion of the petiole or halfway on the petiole.
3. Petals with the limb oblanceolate and decurrent on the claw; laminas narrowly elliptical; Minas Gerais. *P. andersonii* C. Anderson.
3. Petals with the limb orbicular or broadly elliptical, not decurrent; laminas ovate, elliptical, orbicular, or sometimes lanceolate, oblanceolate, or rhombic.
4. Laminas abaxially densely tomentose to wooly, the epidermis obscured; inflorescence axes densely golden-velutinous, the epidermis obscured; limb of the posterior petal 6.6–9.5 (–10.2) mm long, 5.9–9 (–9.6) mm wide; Minas Gerais (in the Serra do Espinhaço and south of it). *P. tomentosa* Adr. Juss.
4. Laminas abaxially with T-shaped hairs to loosely tomentose, the epidermis always visible; inflorescence axes sparsely to densely white-velutinous, the epidermis always visible; limb of the posterior petal 3.5–6.8 mm long, 3–6 mm wide.
5. Stipules adaxially glabrous in the proximal 1/2–2/3, velutinous-tomentulose in the distal 1/3–1/2 and densely so along the margin, forming a white band; laminas abaxially loosely tomentose with the hairs concentrated on the veins; limb of the posterior petal ca. 1/2 as long and wide as the limb of the lateral petals; limb of the lateral petals 9–10.5 mm long, 8.5–9.5 mm wide; Alto Paraguay. *P. floribunda* C. Anderson.
5. Stipules adaxially velutinous or tomentulose over the entire surface; laminas abaxially evenly pubescent, with T-shaped hairs to loosely tomentose; limb of the posterior petal ca. 2/3 as long and wide as the limb of the lateral petals; limb of the lateral petals (4.3–) 5.2–9.5 mm long, (4–) 5–8.5 mm wide; central and eastern Minas Gerais to eastern Paraná. *P. parviflora* Adr. Juss.

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OBSERVATIONS ON THE MALAGASY GENUS RHYNCHOPHORA (MALPIGHIACEAE)

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ABSTRACT. The Malagasy genera *Rhynchophora* Arènes and *Calyptostylis* Arènes are combined under the name *Rhynchophora*, and the new species *R. phillipsonii* W. R. Anderson is described and illustrated. It is morphologically androdioecious but probably functionally dioecious. The distribution of indehiscent fruits in the Malpighiaceae is discussed, with comments on the anomaly of multiseeded indehiscent fruits.

Rhynchophora Arènes, Notul. Syst. (Paris) 12: 127. 1946.—TYPE: *Rhynchophora humbertii* Arènes.

Calyptostylis Arènes, Notul. Syst. (Paris) 12: 131. 1946.—TYPE: *Calyptostylis humbertii* Arènes.

When Arènes described the two monotypic Malagasy genera *Rhynchophora* and *Calyptostylis*, he had mature fruits of the former and only very immature fruits of the latter. He distinguished the two genera on the basis of the fruits, saying that *Rhynchophora* has horizontal wings, one per carpel, at the middle of the indehiscent fruit, while he described the enlarging ovary of *Calyptostylis* as having a crown of rounded appendages at the apex. He also described the flowers of *Rhynchophora* as bisexual and those of *Calyptostylis* as unisexual. I now have flowering and fruiting material of a species that I believe probably represents *Calyptostylis*. Its fruit is fundamentally similar to that illustrated for *Rhynchophora humbertii* by Arènes, and its flowers are staminate on some plants and morphologically bisexual on others. I therefore see no basis for maintaining two genera for these species, and have selected *Rhynchophora* to be the correct name when they are combined. See the description and discussion of *Rhynchophora phillipsonii* below.

In his 1946 discussion, Arènes suggested that *Rhynchophora* is probably closest to another genus endemic to Madagascar, *Microsteira* Baker. I agree; in fact, the genera are so similar that I can distinguish them only on the basis of their ovaries and fruits. The fruit of *Microsteira* breaks apart at maturity into three samaras, each with a small dorsal crest and a three-lobed Y-shaped lateral wing; the similarity to the samara of *Triopterys* L. is striking. One can recognize the initials for the crest and lateral wings on the ovary even in flower. In *Rhynchophora* the three or four carpels are firmly connate and apparently never separate. At maturity each carpel bears a single elliptical wing that is neither dorsal nor lateral, but at right angles to the dorsiventral plane of the carpel. The result is a three- or four-winged fruit that resembles a helicopter with its wings raised ca. 45°. Arènes suggested that the single wing represents the lower lobe of the three-lobed wing of *Microsteira*, but if so it must have shifted its position from the base of the fruit to the middle or apex. Another possibility is that it is derived from the lateral wings of that samara, but it is so strange that the homology is not obvious

and only comparative developmental study is likely to settle the matter. *Rhynchophora* deserves its generic status on the strength of its unique fruit, but given the otherwise strong similarity between it and *Microsteira*, I do not think the difference in their fruits justifies recognizing the tribe Rhynchophoreae Arènes, Notul. Syst. (Paris) 12: 135. 1946, unless one enlarges it to include the sister genus *Microsteira*.

Rhynchophora phillipsonii W. R. Anderson, sp. nov.—TYPE: MADAGASCAR. Toliara: 38 km SW of Ampanihy, on road to Androka, calcareous plateau, 200 m, 24°50'S, 44°25'E, 5 Feb 1990 fl/fr, P. B. Phillipson, J.-N. Labat, D. & B. Du Puy 3451 (holotype: MICH!; isotypes: MO! K!). Fig. 1.

Liana gracilis; lamina foliorum majorum 3.5–6.3 cm longa, 1–3.3 cm lata, anguste elliptica vel anguste ovata vel ovata, adaxialiter mox glabrata, abaxialiter pertinaciter tomentosa vel laxe sericea, petiolo 5–14 mm longo, stipulis interpetiolaribus, 0.7–5.5 mm longis, saepe deciduis; flores staminati vel bisexuales, in plantis separatis portati (species ut videtur androdioecia); calyx eglandulosus; petala alba, ungue ca. 1 mm longo, limbo 4–5 mm longo, 3–3.5 mm lato; flores staminati 10–12 staminibus instructi, sine gynoecio; flores bisexuales 10 staminibus instructi et ovario 3–4-carpellato, stylis 3–4, stigmatibus terminali, magno, adaxialiter inciso; fructus siccus, indehiscens, sericeus, nuce 8–9 mm longa, cylindrica sulcataque, apice 3–4-alatus alis 12–15 mm longis, 5–7.5 mm latis, ellipticis vel obovatis.

Slender woody vine; stems initially golden-sericeous, the hairs fading to white and then deciduous, the older stems glabrate, red to brown. Leaves opposite; lamina of larger leaves 3.5–6.3 cm long, 1–3.3 cm wide, narrowly elliptical or narrowly ovate to ovate, cuneate, truncate, or rounded at base, mostly acute (sometimes slightly obtuse) at apex, initially appressed-puberulent above but soon glabrate, persistently tomentose or loosely sericeous below with the hairs raised, $\pm$ sinuous, white on the lamina, yellow fading to white on the midrib, eglandular or bearing 1 button-shaped gland on margin near base on one or both sides or rarely on abaxial surface of lamina slightly above base, with 5–7 pairs of principal lateral veins, the veins and reticulum prominent below, obscure above; petiole 5–14 mm long, loosely sericeous or tomentose to belatedly glabrescent, mostly eglandular but rarely with 1–2 small glands near apex; stipules 0.7–5.5 mm long, subulate, sericeous except for glabrous apex, borne on stem adjacent to leaf bases, often deciduous. Inflorescence loosely sericeous, paniculate with the flowers borne ultimately in short-stalked umbels or condensed corymbs of 4–13 or more; bracts 0.8–1.5 mm long, subulate or very narrowly triangular, abaxially sericeous, adaxially glabrous, eglandular, $\pm$ persistent; peduncle 0.5–2 mm long; bracteoles like bracts but only 0.3–0.6 mm long, borne at or slightly below apex of peduncle; pedicel 5.5–9 mm long. Flowers apparently radially symmetrical, staminate or morphologically bisexual with the two types borne on different plants. Sepals 5, alike, 1.5–1.8 mm long, 0.8–1 mm wide, distinct, ovate or elliptical, obtuse or rounded at apex, eglandular, abaxially densely sericeous, adaxially glabrous, appressed in anthesis. Petals 5, white, glabrous or with a few straight appressed hairs abaxially in center, spreading in anthesis, the claw ca. 1 mm long, the limb 4–5 mm long, 3–3.5 mm wide, flat or concave, ovate or broadly elliptical, entire or somewhat erose or denticulate. Stamens 10–12 in staminate flowers, 10 in “bisexual” flowers, glabrous, $\pm$ alike; filaments filiform, straight, short-connate only at very base, ca. 2 mm long in “bisexual” flowers (not fully elongated?), 3.5–4.5 mm long in staminate

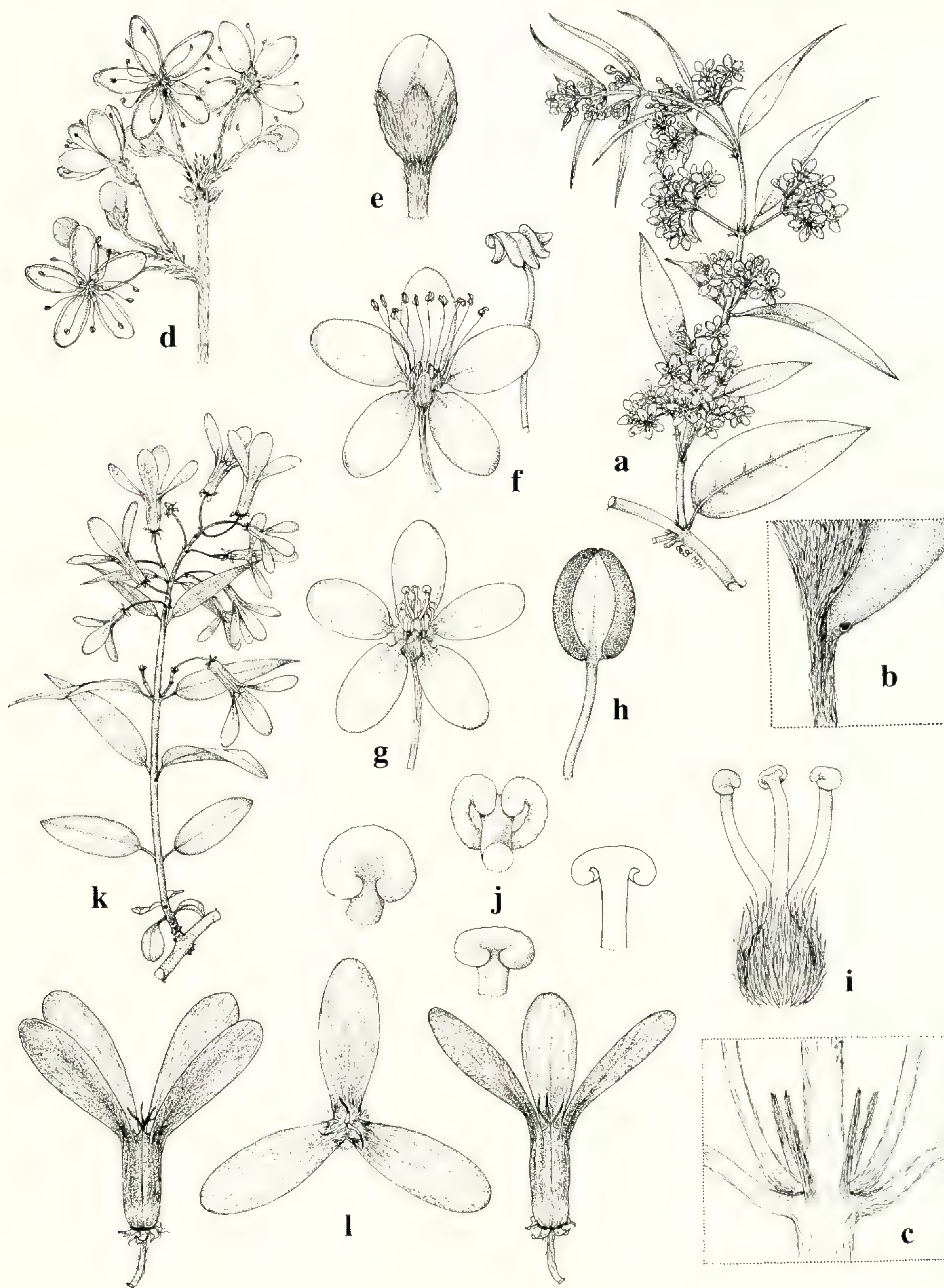


FIG. 1. *Rhynchophora phillipsonii*. a. Branch with staminate flowers, $\times 0.5$. b. Base of lamina with marginal gland, $\times 5$. c. Node with stipules, $\times 2.5$. d. Cluster of staminate flowers, $\times 1.5$. e. Bud of staminate flower, $\times 5$. f. Staminate flower, $\times 2.5$, and old stamen with twisted anther, $\times 15$. g. "Bisexual" flower, $\times 2.5$. h. Young anther from "bisexual" flower, $\times 15$. i. Gynoecium, $\times 10$. j. Style tips, three external views and one longitudinal section, $\times 30$. k. Branch with fruits, $\times 0.5$. l. Fruits, two side views and one from above, $\times 1.5$. C. C. Davis has pointed out that in this species the flowers actually stand with two petals up and one down, rather than one up and two down as shown above. Drawn by Karin Douthit. (Based on: a–f, *Phillipson et al.* 3424; g–l, *Phillipson et al.* 3451.)

flowers; anthers 0.7–1 mm long, opening longitudinally, basifixed, the locules separated on a wide flat connective, becoming twisted in age. Staminate flowers without any rudiment of a gynoecium; gynoecium of “bisexual” flowers 3- or 4-carpellate; ovary ca. 1.3 mm long, cylindrical, densely sericeous, with as many locules as carpels, each locule containing 1 ovule; styles as many as carpels, ca. 2–2.2 mm long (not fully elongated?), slender but of uniform thickness their whole length, straight or slightly arcuate-ascending, the stigma terminal, large, reniform in outline but incised to style on adaxial side, revolute at margin, stigmatic over the whole upper surface. Fruit 3- or 4-carpellate, dry, indehiscent, samaroid, consisting of a cylindrical nut bearing wings at its apex, 1 wing per carpel; nut 8–9 mm long, 3–4 mm in diameter, deeply sulcate between carpels, each carpel with a raised abaxial midrib and very prominent reticulum on sides, densely sericeous; wings 12–15 mm long, 5–7.5 mm wide, elliptical or obovate, rounded at apex, sericeous on both sides and veiny with the veins prominent on both sides, departing from very apex of carpel and raised at an angle of ca. 45° from the horizontal, the plane of the wing perpendicular to the dorsiventral plane of the carpel, each style persistent at base of corresponding wing; seeds not seen.

ADDITIONAL SPECIMENS EXAMINED: **Madagascar**. TOLIARA: N of Toliara, in Forêt de Mikea, 23–25 road-km W of Vorehe, deciduous forest on sand, 50 m, 22°15'S, 43°25'E, Feb yg bud, *McPherson 17383* (MICH) & Feb stam fl, *McPherson 17397* (MICH); 16 km N of Ejeda on Route National 10, 300 m, 24°17'S, 44°29'E, Feb stam fl, *Phillipson 3424 et al.* (K, MO).

The epithet of this species honors Peter B. Phillipson (b. 1957), the South African botanist who collected the type and one of the paratypes.

As noted above, it is quite possible that this species is the same as *Calyplostylis humbertii* Arènes, Notul. Syst. (Paris) 12: 131. 1946, which was described from the same region. I have not seen the type, *Humbert 14358*, and it was so young that the nature of its fruit can only be surmised. In any case, Arènes's name in *Calyplostylis* cannot be used in *Rhynchophora*, because *R. humbertii* is preoccupied; *Rhynchophora humbertii* Arènes is the type of the genus. I have seen no specimens of *R. humbertii*, but Arènes's illustration of its fruit (Notul. Syst. [Paris] 12: 128. 1946) shows the wings attached at or below the middle of the nut, with a long conical projection of the nut above the wings; that difference alone establishes that these are different species. Moreover, Arènes described the petals of *R. humbertii* as 3 mm long and 2 mm wide, with a claw only 0.2 mm long; the petals of *R. phillipsonii* are larger.

The individuals of *Rhynchophora phillipsonii* bear either wholly staminate flowers or apparently bisexual flowers, i.e., the species is morphologically androdioecious, which is a very rare breeding system in flowering plants (G. Anderson & Symon 1989). One therefore wonders whether the pollen in the anthers of the “bisexual” flowers is functional. Unfortunately, the limited material available to me makes a proper study of the pollen in this species impossible at this time. However, I was able to make a superficial comparison of the two pollen types, which I mounted in lactophenol-cotton blue and examined with a light microscope. Both kinds of grains took up the cotton blue, indicating that they both contain cytoplasm, and both are spherical, but otherwise they are significantly different. The pollen from staminate flowers is thick-walled (and correspondingly slow to take up the stain). It lacks ectoapertures, but has (5) 6 (7) non-equatorial pores. The pollen from the morphologically bisexual flowers has walls that are about half as thick, and it takes up the stain much faster. Its diameter is about

20% greater (meaning its volume is about 80% greater). Most importantly, it is (as far as I can tell with the light microscope) completely inaperturate. From these observations I conclude that this species is functionally dioecious, not androdioecious, and the pollen of the “bisexual” flowers serves only as fodder, i.e., as the reward for the pollinators. This pattern is similar to that described by G. Anderson & Symon in *Solanum* (1989). The flowers in *Rhynchophora* bear no calyx glands and (like other Malpighiaceae) have no other kinds of nectaries associated with the flowers, so that (as in the species of *Solanum* discussed by Anderson & Symon) the only obvious reward for pollinators is pollen. If the pollinators visit only flowers that reward them with some kind of pollen, one would expect that the pistillate flowers in a dioecious species would be constrained by selection to retain either anthers with fodder pollen or anther-mimics that can fool the pollinators into visiting the pistillate flowers often enough to effect pollination. In this case the former seems to be the solution adopted. This hypothesis should be tested through careful study of the pollen when ample material is available. Eventually someone with access to living specimens should determine whether the putatively nonfunctional pollen will germinate *in vitro* and on stigmas, and if so, whether it can fertilize the ovules and produce viable seeds. Only one specimen of *Microsteira* with young “bisexual” flowers is available to me, but in that (*McPherson 14360*, MO) the anthers bear large inaperturate pollen grains like those described above for *Rhynchophora phillipsonii*, which suggests that this functional dioecy evolved in the common ancestor of the two genera and any study of the breeding system of *Rhynchophora* should also include *Microsteira*.

The fruit of *Rhynchophora phillipsonii* has the carpels connate only along a narrow central axis of tissue, but in the material available to me they can be separated only by force, for which reason it seems likely that the fruit is dispersed as a single unit. The wall of each carpel has longitudinal corky swellings along the midrib and sides where the dorsal and lateral wings would develop in other genera. The plane of the single wing suggests possible homology with the lateral wings of *Microsteira*, but the wing is never notched and its venation is not double, so there is no evidence that it is derived from displacement upward and fusion of two lateral wings. Given the disposition of wings on the fruit (see Fig. 1), it seems likely that successful dispersal of *R. phillipsonii* requires the fruit's indehiscence, which is almost certainly a derived condition (related genera mostly have the carpels separating at maturity; see Fig. 7 in Davis et al., in press). In the only fruiting collection available to me (*Phillipson et al. 3451*), the seeds are immature, although the fruits appear to be fully formed. Cross-sectioning of a number of those fruits showed that all the locules are well developed and most contain enlarging seeds, which suggests that the fruits are regularly dispersed with three or four seeds together. Such a method of dispersal would not be unique in the Malpighiaceae (see below), but it is certainly unusual in the family and, I suspect, in seed plants in general. One would expect the irrevocable dispersal of several sibling seeds together to be disadvantageous, because only one of them would be able to survive, even if more than one were to germinate. Most multiseeded fruits have evolved mechanisms by which the seeds separate either before or during dispersal, e.g., the seeds of animal-dispersed fruits often separate when voided. Indehiscent fruits have evolved several times in the Malpighiaceae (see Fig. 7 in Davis et al., in press). In *Bunchosia* the seeds surely separate when they are voided, and the same may be true of *Malpighia* (Davis et al., in press). In *Burdachia*, *Dicella*, *Glandonia*, and *Mcvaughia* the fruit is usually one-seeded through abortion of all

but one ovule (W. Anderson 1979, 2001), which avoids the inefficiency of dispersing several seeds together. However, the byrsonimoid clade (*Blepharandra*, *Byrsonima*, and *Diacidia*; see Davis et al., in press, Figs. 5 and 7) produces two or three seeds in a completely indehiscent stone, such that they are most unlikely ever to separate (W. Anderson 2001). My observations of *Caucanthus auriculata* (Radlk.) Nied. and *Tricomaria usillo* Hook. & Arn. suggest that they, like *Rhynchophora*, disperse several seeds together in an indehiscent fruit. Of all the cases cited, the byrsonimoid fruit is the least likely ever to dehisce; there is a possibility that the fruits of *Caucanthus*, *Rhynchophora*, and *Tricomaria* actually do break apart belatedly. If not, there would seem to be an evolutionary anomaly in these several malpighiaceae clades that would repay further investigation.

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JACQUIN'S SPECIES OF BUNCHOSIA (MALPIGHIACEAE) FROM CARTAGENA, COLOMBIA

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ABSTRACT. Neotypes are proposed for *Malpighia diphylla* Jacq., *M. nitida* Jacq., and *M. odorata* Jacq., the basionyms for the three species of *Bunchosia* that Jacquin described from Cartagena, Colombia. *Bunchosia diphylla* (Jacq.) Cuatrec. & Croat is the correct name for what has been called *B. columbica* Nied. *Bunchosia nitida* (Jacq.) DC. is the oldest name for *B. cornifolia* H. B. K. *Bunchosia odorata* (Jacq.) DC. has been in use for various taxa for some time; its typification should stabilize the application of the name.

In 1760, Jacquin described three species of what he considered *Malpighia* from the vicinity of Cartagena, Colombia, with diagnoses that were brief but adequate to effect valid publication. In 1763 he published more complete descriptions of the same species, which were *Malpighia diphylla* Jacq., *M. nitida* Jacq., and *M. odorata* Jacq. At that time all three genera of Malpighiaceae with fleshy fruits (now *Bunchosia* H. B. K., *Byrsonima* H. B. K., and *Malpighia* L.) were still accommodated in *Malpighia*. It is clear from Jacquin's descriptions that *M. nitida* and *M. odorata* could only have been species of *Bunchosia*—both were described as having axillary racemes, a single style (with a bifid stigma in *M. odorata*), and two seeds, all characters of two-carpellate species of *Bunchosia* that would not be found in any species of *Byrsonima* or *Malpighia*. Moreover, the 1763 illustration of the fruit of *M. odorata* (pl. 177, fig. 41) unequivocally establishes its identity as a *Bunchosia*. The generic identity of *M. diphylla* is not quite so obvious. The plant was described as an erect shrub with yellow petals, red berries, and unbranched racemes terminating two-leaved [lateral] branchlets ("in ramusculis diphyllis," 1763, p. 136). Such a plant could not be a *Malpighia*, which always has the petals pink, pale purple, or white (Anderson 2001a). *Byrsonima* has a racemose inflorescence and many species have yellow petals (Anderson 2001a), but the raceme in that genus always terminates main leafy stems, not lateral shoots with only two leaves; I know of no species of *Byrsonima* that would fit Jacquin's description of *M. diphylla*. That fact, plus the fact that there is a species of *Bunchosia* in the Cartagena region that matches Jacquin's description (see below), makes it essentially certain that all three of Jacquin's Cartagena species of *Malpighia* were actually species of *Bunchosia*. Although he did not give all the characters we would like to have, it is still possible to write a simple key to those three species based entirely on Jacquin's 1763 descriptions:

- | | |
|---|----------------------|
| 1. Racemes terminating 2-leaved axillary shoots. | <i>M. diphylla</i> . |
| 1. Racemes axillary, lacking vegetative leaves. | |
| 2. Leaves tomentose on both sides. | <i>M. odorata</i> . |
| 2. Leaves "shining" [i.e., without obvious, spreading vestiture]. | <i>M. nitida</i> . |

Cuatrecasas (1958), in his treatment of *Bunchosia* for Colombia, recorded three species of the genus in the Caribbean lowlands of Magdalena, Atlántico, and Bolívar, including the area of Cartagena visited by Jacquin, and by Humboldt

and Bonpland more than 40 years later (Sprague 1926). Those three species fit the key above, and in most characters agree perfectly with Jacquin's descriptions, so there would seem to be little doubt that they are the same three species, and Jacquin's are the earliest names for them all. Cuatrecasas saw no Jacquin type specimens, Niedenzu (1928) cited no Jacquin collections of *Bunchosia*, and I have never seen a specimen that could be the type for any of these names. Moreover, Stafleu (1971) held out little hope of such specimens ever being found. Therefore, I have decided to propose neotypes for all three names, which is the purpose of this note.

Bunchosia diphylla (Jacq.) Cuatrec. & Croat, Ann. Missouri Bot. Gard. 67: 865. 1981 ["1980"]. *Malpighia diphylla* Jacq., Enum. Syst. Pl. 21. 1760; Select. Stirp. Amer. Hist. 136. 1763. *Byrsonima diphylla* (Jacq.) DC., Prodr. 1: 581. 1824.—TYPE: COLOMBIA. [Magdalena]: Santa Marta, 150 ft, Apr fl, *H. H. Smith 1506* (neotype, here designated: MICH!).

Bunchosia columbica Nied., Repert. Spec. Nov. Regni Veg. 26: 346. 1929.—TYPE: COLOMBIA. [Magdalena]: Santa Marta, *A. Schultze 1614* (holotype: B†, F neg. 12839!).

In 1958 Cuatrecasas used the name *Bunchosia columbica* for this species. He discussed *Malpighia diphylla* as a doubtful species of *Byrsonima*, citing *Romero-Castañeda 1803* (COL), which is from near Cartagena and fits Jacquin's description well. I saw the two sheets of that collection in COL in 1976, and I agree with Cuatrecasas that it represents this species, but it is definitely a *Bunchosia*. Aside from the distinctive inflorescence, the species is notable for its glabrous three-carpellate gynoecium with distinct styles. The mature leaves are sparsely sericeous to glabrate on both sides.

Bunchosia nitida (Jacq.) DC., Prodr. 1: 582. 1824. *Malpighia nitida* Jacq., Enum. Syst. Pl. 21. 1760; Select. Stirp. Amer. Hist. 136. 1763.—TYPE: COLOMBIA. Bolívar: Vicinity of Turbaco, 200–300 m, roadside, 6–22 Nov 1926 fl, *E. P. Killip & A. C. Smith 14689* (neotype, here designated: GH!; isoneotypes: MICH! NY!).

Bunchosia cornifolia H. B. K., Nov. Gen. Sp. 5 [quarto]: 154. 1822 ["1821"].—TYPE: COLOMBIA. [Bolívar]: "Inter Turbaco et Carthagenae de Indias," *Humboldt & Bonpland* (holotype: P-HBK!, F neg. 37491!).

In the Colombian treatment of 1958, Cuatrecasas used *Bunchosia cornifolia* for this species, but mentioned in his discussion that *B. nitida* might be an older name for it. In the 1981 treatment for Panama, he and Croat continued to use *B. cornifolia* without comment. Jacquin's description of *M. nitida* fits the species well. The mature leaves are glabrate and shining above, and while the abaxial surface is actually thinly sericeous with very short, transparent, strongly appressed hairs, it appears glabrous to the naked eye. I have already used the name *Bunchosia nitida* for this species in Nicaragua (Anderson 2001b), and intend to do the same in the floristic treatment now in preparation for Costa Rica. The gynoecium in *B. nitida* is two-carpellate and densely sericeous on both the ovary and the style; the two styles are completely connate, except that the stigmas are distinct. The fruit is unusually large for *Bunchosia*, 15–30 mm long when dried.

Bunchosia odorata (Jacq.) DC., Prodr. 1: 582. 1824. *Malpighia odorata* Jacq., Enum. Syst. Pl. 21. 1760; Select. Stirp. Amer. Hist. 136–137, pl. 177, fig. 41. 1763.—TYPE: COLOMBIA. Bolívar [now Sucre]: Alrededores de Colosó, 26 Apr 1963 fl, R. Romero-Castañeda 9750 (neotype, here designated: NY!; isoneotypes: MICH! MO!).

Bunchosia pilosa H. B. K., Nov. Gen. Sp. 5 [quarto]: 156. 1822 [“1821”].—TYPE: COLOMBIA. [Bolívar]: “Pr. Turbaco,” fl, *Humboldt & Bonpland* (holotype: P-HBK!, WRA neg. 81-10-32; single leaf, probable fragment of holotype: F!).

This name has been in general use since Cuatrecasas applied it to this species in 1958. Niedenzu (1928) treated *B. odorata* as a species of uncertain position and used the name *Bunchosia pilosa*. The leaves are densely and persistently velutinous on both sides, with V-shaped hairs, quite unlike the other species in the area of Cartagena, so there can be no real doubt about the application of the name. As Cuatrecasas pointed out (1958, pp. 578–579), Jacquin in 1763 provided two descriptions for this plant, and they are somewhat contradictory. The first, on p. 136, states that the gynoeceum is bicarpellate and the two styles are completely connate. The second, on p. 137, states that the gynoeceum is sometimes bicarpellate and sometimes tricarpetate, and the styles are sometimes completely connate and sometimes distinct. Cuatrecasas stated that the plants from the area of Cartagena are consistently bicarpellate with the styles completely connate, and my own observations agree with his. It seems most likely that Jacquin’s second description was based on a different species, not the one from Cartagena. It is rare for species of *Bunchosia* to vary in number of carpels, but that does occur in *B. mollis* Benth., which has velutinous leaves that can be very similar to those of *B. odorata* (Anderson 2001a). *Bunchosia mollis* is not known from Colombia, but it does occur in the coastal states of Venezuela, which Jacquin visited (Stafleu 1971). I suspect that Jacquin examined *B. mollis* when he was in Venezuela and later confounded notes on it, in the description on p. 137, with notes made on *B. odorata* at Cartagena, the source of the description on p. 136. In any case, this situation is further justification, if any were needed, for stabilizing the name through neotypification.

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NOTES ON NEOTROPICAL MALPIGHIACEAE—VIII

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ABSTRACT. A lectotype is proposed for *Bunchosia gracilis* Nied. that will make it a synonym of *B. lindeniana* Adr. Juss. Four new species are described and illustrated: *Bunchosia grayumii* W. R. Anderson (Costa Rica and Panama), *Byrsonima flexipes* W. R. Anderson (Colombia and Venezuela), *Heteropterys aequatorialis* W. R. Anderson (Ecuador and Peru), and *Mezia russellii* W. R. Anderson (Peru); four additional species are described without illustration: *Bunchosia mesoamericana* W. R. Anderson (Guatemala, Honduras, Nicaragua, and Costa Rica), *Bunchosia stipulacea* W. R. Anderson (Panama), *Heteropterys hammelii* W. R. Anderson (Costa Rica), and *Hiraea fosteri* W. R. Anderson (Panama).

This article is a miscellany comprising one lectotypification and eight new species. Most of the latter are proposed as supplements to recently published floristic treatments or in anticipation of other floristic treatments due to be submitted in the next few years.

Bunchosia gracilis Nied., Ind. Lect. Lyc. Reg. Hos. Brunsberg. p. hiem. 1898–1899: 5. 1898.—TYPE: GUATEMALA. Alta Verapaz: Alta Verapaz, Pansamalá, 3800 ft, Sep 1886 fl, *H. von Türckheim in J. D. Smith 1033* (lectotype, here designated: US!; isoelectotypes: GH! K! NY!).

Among the four syntypes of this name there were at least two species, perhaps more. The lectotype chosen here is a specimen of *Bunchosia lindeniana* Adr. Juss.; I hope that by making this selection I shall succeed in consigning a poorly characterized name to synonymy.

Bunchosia grayumii W. R. Anderson, sp. nov.—TYPE: COSTA RICA. Limón: Reserva Biológica Hitoy Cerere, from Río Cerere to Cerro Bobókara, understory in rainforest, 100–600 m, 26 Feb 1991 fl, *F. Almeda 6812* (holotype: MICH!; isotype: CAS!).

Fig. 1.

Frutex vel arbor parva 1.3–5 (–12?) m alta; lamina foliorum majorum 11–16 (–19.5) cm longa, 4.7–7.6 cm lata, margine discolor, apice acuminata, mox glabrata, abaxialiter utrinque (3–) 6–10 glandulis parvis in 1 serie instructa; petiolus 5–12 mm longus; inflorescentiae 3.5–8.5 cm longae, ex 12–20 floribus ± decussatis constantes; pedicellus pertinaciter sericeus; petala omnia eglandulosa; gynoecium 2-carpellatum, glabrum, 4–4.5 mm longum; stylus ut videtur 1, ex 2 connatis constans, stigmatate discoideo integro; fructus siccus ruber, 8–9 mm longus, 8–9.5 mm diametro, glaber, pariete laevi.

Shrub or small tree 1.3–5 (–12?) m tall; stems thinly sericeous to glabrate, often dark reddish. Lamina of larger leaves 11–16 (–19.5) cm long, 4.7–7.6 cm wide, elliptical or slightly ovate or obovate, cuneate at base, thin, slightly revolute, and often discolored (brown or dark reddish) at margin (at least in dried specimens),

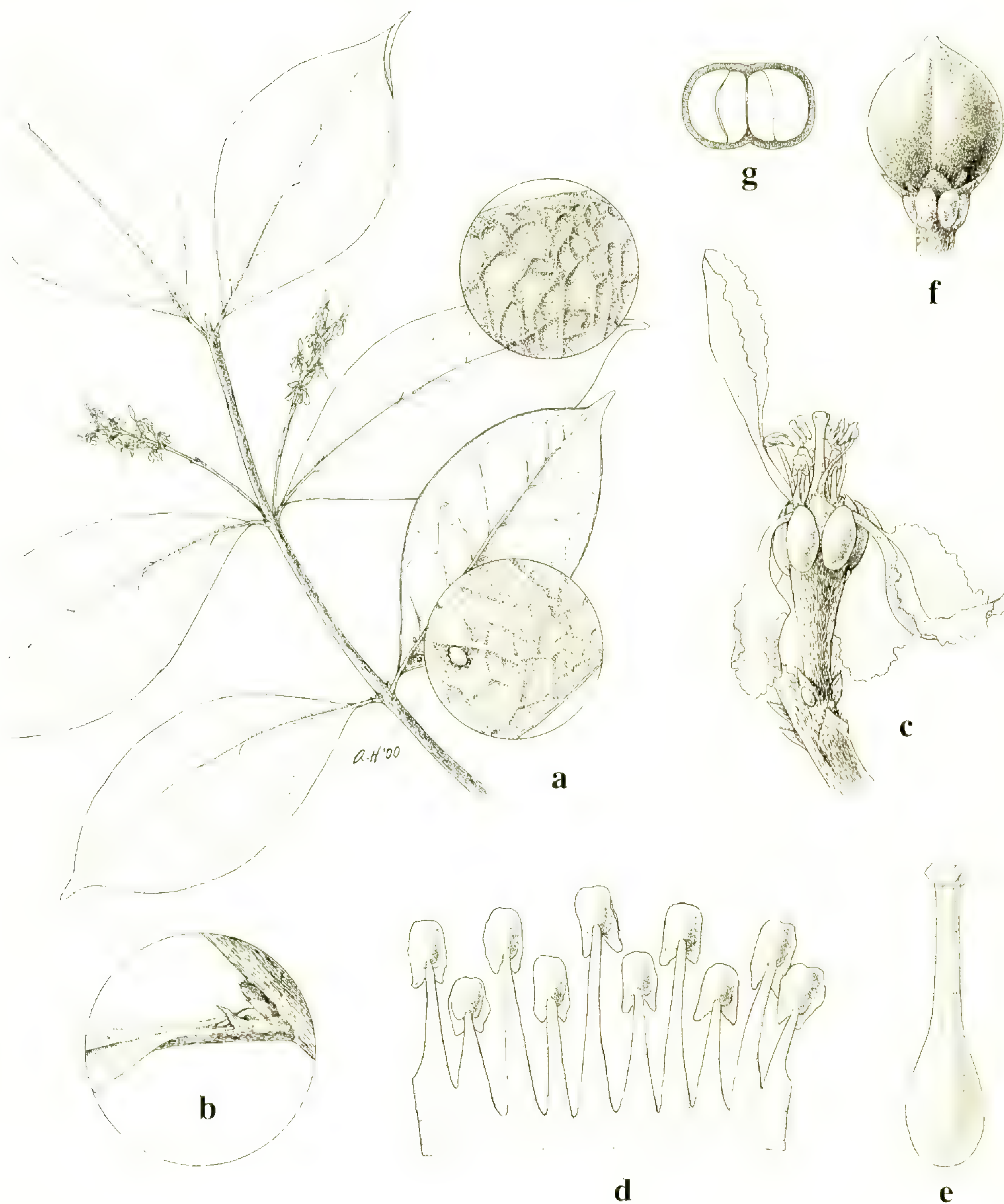


FIG. 1. *Bunchosia grayumii*. a. Flowering branch, $\times 0.35$, with enlargements of adaxial surface of lamina (above) and abaxial surface including gland (below), $\times$ ca. 6. b. Petiole with stipules, $\times 2$. c. Node of pseudoraceme and flower, side view with posterior petal to left, $\times 3.5$. d. Androecium laid out, abaxial view, with stamen at right opposite posterior petal, $\times 8.5$. e. Gynoecium, $\times 8.5$. f. Fruit, $\times 2$. g. Cross-section of fruit, $\times 2$. Drawn by Amanda Humphrey. (Based on: a–e, *Almeda 6812*; f–g, *González 1555*.)

$\pm$ abruptly acuminate at apex with the acumen 5–13 (–18) mm long, initially very sparsely sericeous on both sides, especially on midrib, the hairs short, white, straight, appressed, but soon glabrate, the principal lateral veins 5–8 on each side, the intricate reticulum prominent on both sides in young leaves but often becoming barely visible in older thicker leaves, the abaxial glands 0.6–1 (–1.2) mm in diameter, rarely only 3–4 on each side in the proximal 1/3 but usually 6–10 in a row diverging from near the midrib and 5–15 mm above the base, extending outward distally with the most distal glands 1/2–2/3 of the distance toward the apex and 2–11 mm

from the margin; petiole 5–12 mm long, thinly sericeous to glabrate, eglandular; stipules 0.5–1.2 mm long. Pseudoracemes 3.5–8.5 cm long, mostly axillary to vegetative leaves, unbranched and without vegetative leaves, but occasionally paired at the apex of a leafless axillary branch ca. 1 cm long with the 2 pseudoracemes axillary to bracts, the axis sericeous, the 12–20 flowers mostly decussate or some decussate and others in no regular order; bracts and bracteoles persistent; bracts 0.9–1.7 mm long; peduncle (0–) 0.5–1.8 mm long; bracteoles 0.5–1 mm long, 1 of the pair (occasionally both) bearing 1 large, eccentric, sessile or slightly peltate abaxial gland; pedicel 2.5–4.5 mm long (–5.5 mm in fruit), often somewhat inflated distally, persistently sericeous. Sepals 1–1.5 mm long beyond glands, 1.5–2 mm wide, broadly rounded at apex, abaxially glabrous, ciliate on margin, adaxially glabrous, appressed in anthesis; glands well developed, 8, all distinct or some pairs from adjacent sepals up to 1/2 connate, 2.3–3 mm long, the anterior 2 shortest and the posterior 2 longest, ovate or elliptical, not or hardly compressed, glabrous, free and $\pm$ spreading in the distal 1/2, the longest 2 somewhat to strongly decurrent onto pedicel. Petals lemon-yellow, glabrous, erose or dentate, all eglandular but the proximal teeth sometimes slightly thickened and rounded; lateral petals reflexed, with the claw 2–3 mm long and limb 4–6 mm long, 4–7 mm wide, the anterior pair larger and deeply cupshaped (especially the outermost), the posterior pair shallowly concave; posterior petal erect, with the slender claw ca. 3.5–4.5 mm long, widening gradually into the obovate limb 3–5 mm long, 3–4.5 mm wide, flat or shallowly concave. Stamens glabrous; filaments 2.5–3 mm long opposite sepals, 1.5–2.5 mm long opposite petals, longest opposite anterior sepal, white, membranous, connate basally up to 1 mm; anthers 0.8–1.3 mm long, the connectives somewhat glandular-swollen, yellow to brown. Gynoecium 2-carpellate, glabrous, flask-shaped with the 2-locular ovary ca. 1.5 mm high and merging gradually into the style; style apparently 1, actually 2 completely connate, ca. 2.5–3 mm long, reaching as high as or higher than the anthers, the single large discoid stigma entire. Fruit red, 8–9 mm long, 8–9.5 mm in diameter (dried), globose or 2-lobed, glabrous, the wall smooth throughout development.

In understory of wet tropical forests at 100–700 m in Caribbean lowlands of Limón, Costa Rica, and adjacent Panama; collected with flowers in February, March, July, September, and November, and with fruits in October, November, and January.

ADDITIONAL SPECIMENS EXAMINED. **Costa Rica.** LIMÓN: Reserva Biológica Hitoy Cerere, Valle de la Estrella, 9°4'30"N, 83°01'20"W, *Carballo* 241 (INB, MICH), 427 (INB, MO); Cantón de Talamanca, R.I. Talamanca, Baja Talamanca, Senderos Revienta-pechos y Espaval, 9°33'N, 83°01'W, *Carballo* 448 (INB); cerca del pozo San José #1 (RECOPE), 9°35'N, 82°58'W, *Cowan* 4584 (CAS, MICH, TEX); Cantón de Talamanca, Faja Costeña de Limón, Puerto Viejo, *González* 516 (CR, MO); Cantón de Talamanca, cuenca del Sixaola, San Miguel, Asacode, alrededores de la estación, 9°34'30"N, 82°40'00"W, *González* 1555 (INB); hills ca. 2 km S of Manzanillo de Talamanca, E of Quebrada Hone Wark, 9°37'N, 82°39.5'W, *Grayum et al.* 4384 (CR, MO); Talamanca, Fila Carbón, Buena Vista, 9°39'34"N, 82°53'54"W, *Valverde* 16 (CR). **Panama.** BOCAS DEL TORO: Filo Almirante, trail to Riscó Abajo, 3 km SW of town of Almirante, *Nee & Hansen* 14112 (F, MO, WIS).

The epithet of *Bunchosia grayumii* honors Michael H. Grayum, b. 1949, in recognition of his many years of work on the flora of Costa Rica. *Bunchosia grayumii* falls into the group of species with a glabrous bicarpellate gynoecium and leaves that are sparsely sericeous to glabrate. In Costa Rica the species that most resembles it is *B. polystachia* (Andr.) DC., from which it can be distinguished by the following couplet:

Leaves with an abaxial row of (3-) 6-10 glands on each side, the glands mostly 1 mm or less in diameter; fruit up to 9 mm long, smooth throughout development, red; margin of lamina discolored, brown or dark reddish in dried specimens; pedicels persistently sericeous; petiole of larger leaves 5-12 mm long; stigmas completely connate into 1 large, discoid, entire stigma.

B. grayumii.

Leaves with mostly 1 abaxial gland (rarely 2) on each side near base, the glands 1-2 mm in diameter; fruit 9-14 mm long, granular when young, becoming smooth only at full maturity, yellow to red; margin same color as rest of lamina; pedicels glabrous or only sparsely sericeous; petiole of larger leaves 3-6 mm long; stigmas usually distinct.

B. polystachia.

Bunchosia grayumii is also notable for the posterior petal with its long claw that widens gradually into the limb, and for the flask-shaped gynoecium with its long, slender style.

Bunchosia mesoamericana W. R. Anderson, sp. nov.—TYPE: GUATEMALA. Zacapa: Gualán, ravine, 620 ft, 20 Jun 1909 fl, C. C. Deam 6363 (holotype: MICH!; isotypes: F! GH! MO! NY! US!).

Frutex vel arbor parva 3-8 (-10) m alta, ramis lenticellis instructis; lamina foliorum majorum 6-13 (-17) cm longa, 3-7 (-9) cm lata, ovata vel elliptica, apice plerumque acuminata, abaxialiter tomentosa vel glabrescens et utrinque costae 1 (aliquando 2, rarissime 3) glandulis instructa; petiolus 4-10 mm longus; stipulae 0.5-1.2 mm longae; inflorescentiae 3-11 cm longae, ex 8-24 (-32) floribus plerumque decussatis constantes; petala omnia eglandulosa; gynoecium 2-carpellatum, tomentosum; stylus ut videtur 1, ex 2 connatis constans; fructus siccus 12-20 mm longus et diametro, glabrescens, pariete laevi.

Shrub or small tree 3-8 (-10) m tall; stems thinly sericeous to glabrate, soon developing many punctiform lenticels. Lamina of larger leaves 6-13 (-17) cm long, 3-7 (-9) cm wide, ovate or elliptical, cuneate and often slightly decurrent at base, mostly acuminate at apex but sometimes acute and rarely obtuse, initially appressed-tomentose or subsericeous above but soon glabrate, persistently tomentose below or glabrescent at maturity with some hairs persistent at least on midrib, the hairs sessile or short-stalked, white and very fine, somewhat sinuous to strongly twisted with the longer hairs loose, spreading, non-parallel, 1-1.5 mm long, the abaxial glands 0.3-1.2 mm in diameter, typically 1 on each side between midrib and margin in proximal 1/3, occasionally with 1 additional gland distally on one or both sides and very rarely an inframarginal row of 2 or 3; petiole 4-10 mm long, loosely sericeous or tomentose to glabrate, eglandular; stipules 0.5-1.2 mm long. Pseudoracemes 3-11 cm long, axillary, without leaves and unbranched, the axis sericeous to glabrescent in fruit, the 8-24 (-32) flowers mostly decussate; bracts and bracteoles persistent; bracts 0.7-2.5 mm long; peduncle (0.5-) 1-4 mm long; bracteoles 0.5-1 mm long, both eglandular or 1 of the pair bearing 1 small sessile abaxial gland; pedicel (2-) 3-6 mm long (-7.5 mm in fruit), often somewhat inflated distally, thinly sericeous to glabrate. Sepals 1.5-2.2 mm long beyond glands and 1.2-1.7 mm wide, broadly obtuse or rounded at apex, abaxially glabrous or bearing a few hairs at base, ciliate on margin, adaxially glabrous, erect to spreading and revolute on sides in anthesis; glands rudimentary or, if well developed, 8 (from 10 with the anterior 4 connate in pairs?), 1.4-2.4 mm long, the anterior 2 shortest and the posterior 2 longest, obovate, compressed, glabrous, the longest 2 very slightly decurrent onto pedicel. Petals yellow, glabrous, erose or dentate or irregularly lacerate, especially the outermost, all eglandular on margin; lateral

petals with the claw 2–3.5 mm long and the limb 4–6 mm long, 4–7 mm wide, the anterior pair cupshaped, the posterior somewhat concave to nearly flat; posterior petal with the wide claw 3–3.5 mm long, the limb 4 mm long and wide, flat. Stamens glabrous; filaments 2.5–4 mm long opposite sepals, 2–3.5 mm long opposite petals, longest opposite anterior sepal, shortest opposite posterior petal, white, membranous, connate in proximal 0.8–1.2 mm; anthers 0.6–1.2 mm long, the connectives somewhat glandular-swollen, initially light brown, turning darker with age. Gynoecium 2-carpellate; ovary 1.2–1.8 mm high, tomentose, 2-locular; style apparently 1, actually 2 completely connate, 2–2.7 mm long, reaching about as high as anthers or a little shorter, densely tomentose, the 2 stigmas distinct. Fruit orange to red, 12–20 mm long and in diameter (dried), globose or 2-lobed, thinly sericeous or tomentose to nearly glabrate, the wall smooth throughout development.

The epithet refers to the fact that the distribution of this species is wholly within Central America.

Mostly in dry thickets, ravines, and forests of Guatemala, Honduras, Nicaragua, and Costa Rica, from sea level to 1450 m; collected with flowers (March–) May–October and with fruits July–November.

ADDITIONAL SPECIMENS EXAMINED. **Honduras.** COMAYAGUA: carretera a Villa Chicúas, *Molina R.* 10989 (F, MO, NY); Valle Comayagua, *Molina R.* 5762 (F, US).—EL PARAÍSO: Valle Jamastrán, *Molina R.* 7497 (F, US).—FRANCISCO MORAZÁN: alrededores de la Ciudad Universitaria, Tegucigalpa, *Andino B.* 151 (MICH, MO), Trayecto “La Tigra,” *Bustillo* 71 (MICH), Quebrada La Orejona, *Espinal* 65 (MICH), orillas Quebrada La Orejona, *Gómez* 193 (NY), Quebrada la Orejona, *Ruiz* 193 (NY), Quebrada Orejona, *Tróchez* 139 (MICH), *Villeda* 195 (MICH, MO); cerca de la Travesía, *Molina R.* 1130 (F, GH, US); carretera vieja entre Suyapa y San Roque a Tegucigalpa, *Molina R.* 14570 (F, NY, US); Quebrada Suyapa, aldea de Suyapa, NW de Tegucigalpa, *Molina R.* 2552 (F, GH, US); abajo de Suyapa, entre Villa San Roque y Tegucigalpa, *Molina R.* 2777 (F, GH, US); Guamiles de la aldea de la Travesía, *Molina R.* 3264 (F, GH); Santa Lucía, *Molina R.* 3290 (F, GH); Tegucigalpa, SE Colonia Luis Landa, calle a Colonia Florencia, *Nelson* 8612 (MO); Cerro El Picache, Tegucigalpa, *Rodríguez* 197 (MICH, MO); vicinity of Suyapa, region of La Travesía, *Standley* 12432 (F), Villa San Roque, *Standley* 22263 (F, US), *Standley* 26448 (F, GH, US). **Nicaragua.** ESTELÍ: faldas del Chayote, *Moreno* 21782 (MICH); vicinity of Condega, *Standley* 20386 (F); 15.5 mi N of Estelí, *Webster et al.* 12065 (F, GH, MO, US).—MADRIZ: 20 km SE of Somoto, *Harmon & Fuentes* 6004 (ENCB, MO); mountains above Somoto, *Williams & Molina R.* 10942 (F, GH, US). **Costa Rica.** GUANACASTE: Parque Nacional Santa Rosa, Liberia, de Bahía Salinas a Santa Cecilia, *Espinoza* 461 (CR, INB, MICH), *Janzen* 10098 (MO), *Janzen* 10197 (MICH), 30 km NW of Liberia, *Janzen* 11795 (MO, NY), 1 km left of fork in road to Playa Naranjo, *Liesner* 2236 (F, MO), Río Pozo Salada, *Liesner* 2283 (CR, F, MO), along Río Guapote, *Liesner & Lockwood* 2612 (CR, MO), slope below Questa and lowland forest at fork in road to Playa Naranjo, *Liesner et al.* 3389 (MO), 30 km NW of Liberia, *Stevens* 44 (MO), 14 km SW of Carretera Interamericana, 36 km NW of Liberia, *Wilbur* 21448 (DUKE), 15 km SW of entrance, *Wilbur* 22900 (CR, DUKE, F, MICH), 35 km NW of Liberia, 2 km from beach at Playa Naranjo, *Wilbur* 26597 (DUKE), ca. 12 km SW of park entrance, *Wilbur* 26602 (DUKE); Sendero Hato Viejo, P.N. Paloverde, 10°23'N, 85°23'W, *Chavarría* 628 (INB, MICH); Liberia, P.N. Guanacaste, Cerro Cacao, Estación Cacao, 10°55'45"N, 85°28'15"W, *Chávez* 596 (CR); vicinity of Cañas, Finca La Pacífica, *Daubenmire* 805 (F), Río Corobici, *Gentry* 853 (F, MO), *Haber* 35 (MO, US), *Haber* 58 (MO), *Opler* 1789 (F, MO, UC), *Seigler* 12777 (NY); La Cruz, Cordillera de Guanacaste, Estación Orosí, camino a áreas de petroglifos, 10°57'48"N, 85°29'49"W, *Fernández* 1730 (INB); Paloverde, OTS Field Station 8 km W of Bagaces, *Gentry* 71473 (MO); Parque Rincón de la Vieja, Hacienda Santa María, sendero a las pailas, 10°48'N, 85°10'W, *Herrera* 700 (MICH).

Bunchosia mesoamericana is to be compared to other species with a tomentose bicarpellate gynoecium. From most of those it is immediately distinguished by its tomentose leaves with long, sinuous to twisted hairs, its leaf glands, which are mostly only two in the basal third of the lamina, and the fruit with a smooth (i.e., non-granulate) wall. Other useful characters are the punctiform lenticels, the

often well-developed peduncles, the sepals nearly glabrous except for the ciliate margin, and the eglandular petals. When the calyx glands are rudimentary that is a distinguishing character, because that condition is rare in *Bunchosia*, but some populations have normal, well-developed calyx glands. Another interesting peculiarity of *B. mesoamericana* is having the longest filaments in the front of the flower and the shortest near the posterior petal.

In my treatment for the *Flora de Nicaragua* (Anderson 2001b, p. 1264) this species was called "*Bunchosia* sp. A."

Bunchosia stipulacea W. R. Anderson, sp. nov.—TYPE: PANAMA. Chiriquí: Burica Peninsula, Monte Verde, 2.5 km W of the center of Puerto Armuelles, edge of open pasture and thicket of trees along creek, 80 m, 18 Feb 1973 fr, *P. Busey* 409 (holotype: MO!; isotypes: BM! CR! MEXU! MICH! NY! XAL!).

Frutex usque ad 4 m altus; lamina foliorum majorum 18–21.5 cm longa, 9–13.5 cm lata, late elliptica vel ovata, basi rotundata, apice apiculata vel abrupte brev-acuminata, abaxialiter $\pm$ pertinaciter sericea vel demum glabrescens, utrinque basi 1–3 glandulis ellipticis 1–2 mm longis et distaliter 7–16 glandulis (0.4–) 0.7–1.5 mm diametro in 1 serie instructa; petiolus 10–15 (–17) mm longus; stipulae (3.5–) 4–5 (–6) mm longae, asymmetricae; pseudoracemus (10–) 13–20 cm longus, axillaris, ex (16–) 20–52 floribus constans; petalum posticum ungue 5 mm longo, limbo 4.5 mm longo latoque minimum proximaliter glanduloso-dentato; gynoeceum tricarpellatum, sericeum, stylo unico (ex 3 connatis) ca. 3 mm longo, stigmatibus distinctis; fructus aurantiaco-ruber, 10–12 mm longus, 15–17 mm diametro (siccus), sericeus vel glabrescens.

Shrub up to 4 m tall; stems initially densely sericeous, glabrescent and developing punctiform or elliptical lenticels in age. Lamina of larger leaves 18–21.5 cm long, 9–13.5 cm wide, broadly elliptical or slightly ovate, rounded at base, flat or slightly revolute at margin, rounded and usually apiculate or abruptly short-acuminate at apex with the apex 6–10 mm long, initially densely and rather loosely sericeous on both sides, soon glabrate above or with some hairs persistent especially on midrib and lateral veins, persistently loosely sericeous below with fine white hairs 0.5–1 mm long or unevenly glabrescent in age, the principal lateral veins 8–11 pairs, the abaxial glands on each side 1–3 near base (those elliptical, 1–2 mm long, pressed against midrib) and distally 7–16 (or more?) in $\pm$ a single row, between midrib and margin, (0.4–) 0.7–1.5 mm in diameter, circular, most numerous and largest in distal third; petiole 10–15 (–17) mm long, densely sericeous to glabrescent, eglandular or (often) bearing 2 large glands near apex; stipules (3.5–) 4–5 (–6) mm long, (1.2–) 1.5–2 mm wide, lanceolate or ovate and asymmetrically naviculiform (wider toward axil than toward node), sericeous to glabrate in age. Pseudoracemes (10–) 13–20 cm long, axillary to vegetative leaves, unbranched and without vegetative leaves, the axis sericeous to eventually glabrate, the (16–) 20–52 flowers almost all decussate from base to apex; bracts and bracteoles persistent; bracts 1.5–3 mm long; peduncle 1–4 mm long; bracteoles 0.7–2 mm long, 1 of each pair bearing 1 large $\pm$ decurrent abaxial gland; pedicel 3–6.5 mm long, sericeous to glabrate. Sepals 1.5–2 mm long and wide beyond attached part of glands, triangular, rounded at apex, abaxially densely and evenly sericeous, adaxially glabrous, appressed in anthesis; glands well developed, 8–9, all distinct or 2 from adjacent sepals $\pm$ completely connate, 2–3.5 mm long, elliptical or obovate, glabrous,

free distally, the posterior 2–4 sometimes decurrent onto pedicel. Petals yellow, glabrous; lateral petals reflexed, with the claw 2–2.5 mm long and limb 6–7 mm long, 4.5–6 mm wide, shallowly to deeply concave (the anterior pair cupshaped), repand or erose, eglandular; posterior petal with the claw erect and the limb spreading, the claw 5 mm long, widening gradually into the obovate limb ca. 4.5 mm long and wide, flat, glandular-dentate on proximal half or all around the margin with the glands largest proximally and much reduced to absent distally. Stamens glabrous; filaments 2.5–3.5 mm long opposite sepals, 2–3 mm long opposite petals, white, membranous, connate up to 1.2 mm; anthers 1.1–1.8 mm long, the connective somewhat glandular-swollen, yellow. Gynoecium 3-carpellate, densely and tightly sericeous its whole length including the style, flask-shaped with the 3-locular ovary ca. 1.5 mm high and merging gradually into the style; style apparently 1, actually 3 completely connate except for the 3 stigmas, ca. 3 mm long. Fruit orange-red, 10–12 mm long and 15–17 mm in diameter (dried), 3-lobed, sericeous to glabrate, the wall granulate even at maturity.

Endemic to the moist lowlands of southern Chiriquí, Panama, at elevations up to 150 m; to be expected in adjacent southernmost Costa Rica; collected with flowers in August and December and with fruits in February.

ADDITIONAL SPECIMENS EXAMINED. **Panama.** CHIRIQUÍ: along Río Dupí, near sea level, Dec fl, *Pittier 5226* (F, US); Río San Cristóbal, 2 mi W of David, in brush, 150 ft, Aug fl, *Tyson 911* (MO).

The epithet I have proposed for this species refers to its unusually long stipules. Cuatrecasas originally annotated some of the specimens cited here with the unpublished epithet “pittieri,” but in their treatment for the *Flora of Panama* (1981) Cuatrecasas and Croat used the name *Bunchosia lanieri* S. Watson for the plants of Panama. I agree that the two species are similar, but true *B. lanieri* seems to be limited to Belize, Guatemala, and Honduras. The following couplet distinguishes between them:

Stipules (3.5–) 4–5 (–6) mm long, asymmetrical; pseudoraceme (10–) 13–20 cm long, containing (16–) 20–52 flowers; leaf glands distal to base (0.4–) 0.7–1.5 mm in diameter, 7–16 (or more?) on each side in $\pm$ a single row between midrib and margin, most numerous and largest in distal third; gynoecium tightly sericeous. *B. stipulacea.*

Stipules 1–2.5 mm long, symmetrical; pseudoraceme 7–12 cm long, containing 10–24 flowers; leaf glands distal to base 0.1–0.4 mm in diameter, (few–) many on each side, tracking the midrib and/or scattered over the lamina but never in a single row between midrib and margin, diminishing in number (and often in size) in distal third; gynoecium tomentose. *B. lanieri.*

Byrsonima flexipes W. R. Anderson, sp. nov.—TYPE: VENEZUELA. Amazonas: Depto. Atabapo, orilla del Río Cuchaken, 3°31'N, 67°22'W, 100 m, Oct 1989 fr, *J. Velazco 831* (holotype: MICH!; isotypes: MO! NY! PORT!). Fig. 2.

B. rodriguesii W. R. Anderson affinis sed stipulis 2–2.5 mm longis, pedicellis in fructu sigmoideis 0.8–1 mm diametro, sepalis abaxialiter pubescentibus, fructibus siccis 6–8 mm diametro differt.

Tree 3–15 m tall; vegetative internodes glabrous except hirsute in axil of stipules. Leaves glabrous; lamina of larger leaves (11–) 12.5–17.5 cm long, (5–) 6.5–8.5 cm wide, elliptical or slightly obovate, cuneate and somewhat decurrent at base, falcate distally, abruptly short-acuminate at apex with the acumen 5–12 mm long, the 8–11 pairs of principal lateral veins visible on both sides, the reticulum visible below; petiole (18–) 22–33 mm long; stipules 2–2.5 mm long, distinct, broadly



FIG. 2. *Byrsonima flexipes*. a. Fruiting branch, $\times 0.5$. b. Stipules, adaxial view, $\times 5$. c. Inflorescence axis showing bracts, bracteoles, and base of one pedicel, $\times 5$. d. Enlarging fruit closely invested by accrescent sepals, $\times 2.5$. e. Fruit from above, $\times 3$. Drawn by Karin Douthit. (Based on Velazco 831.)

ovate or triangular, abaxially glabrous, adaxially densely appressed-hirsute. Inflorescence 9–25 cm long in fruit, velutinous, with the flowers borne in dense cincinni of (1–) 2–3 (or more?), the cincinni sessile or raised on a stalk up to 4 mm long; bracts and bracteoles 1–3.5 mm long, triangular-linguiform, sparsely sericeous or

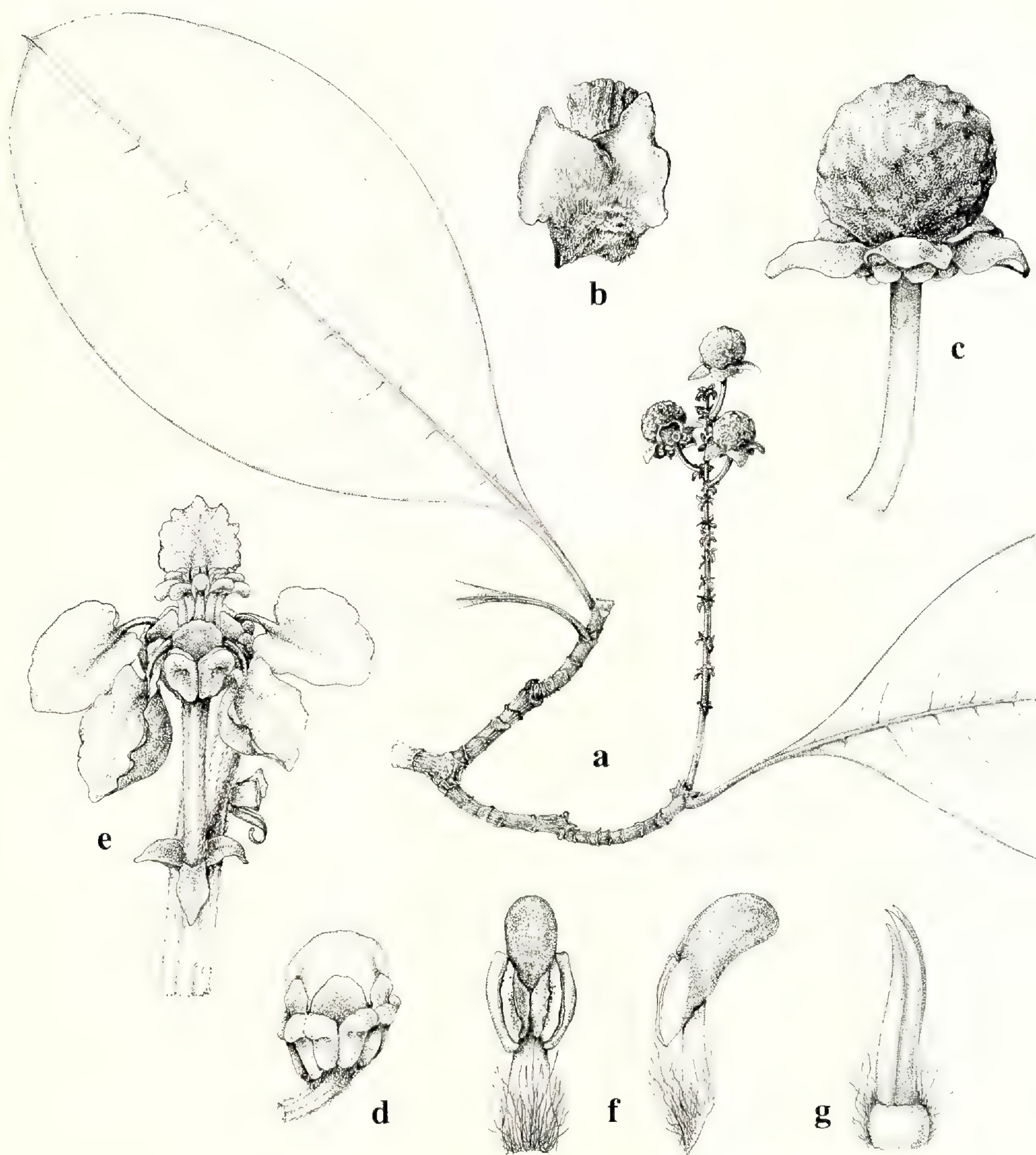


FIG. 3. *Byrsonima rodriguesii*. a. Fruiting branch, $\times 0.5$. b. Stipules, adaxial view, most hairs removed, $\times 2.5$. c. Fruit (dried), $\times 2$. d. Flower bud, $\times 2.5$. e. Flower, $\times 2.5$. f. Stamens, adaxial view (left) and side view (right), $\times 7.5$. g. Gynoecium (glabrous ovary shown surrounded by hairs on the receptacle), $\times 5$. Modified from the protologue (Mem. New York Bot. Gard. 32: 103. 1981).

ciliate on margin to nearly glabrous, reflexed to revolute, persistent past maturity of the fruit; peduncle none or very short; pedicel ascending and becoming sigmoid in fruit, 8–12 mm long, 0.8–1 mm diameter, $\pm$ velutinous. Sepals all biglandular, abaxially sparsely velutinous or sericeous, adaxially glabrous, enlarging to 5–7 mm long and 3–4.5 mm wide in fruit, the accrescent sepals often closely investing the enlarging fruit, later reflexing; petals and stamens unknown; gynoecium presumably glabrous. Fruit (dried) 6–8 mm in diameter, glabrous, the nut prominently bony-rugose.

Lowland forests near streams, in Amazonas, Venezuela, and Caquetá, Colombia; unknown with flowers, collected with fruits in October, November, and February.

ADDITIONAL SPECIMENS EXAMINED. **Colombia.** CAQUETÁ: Parque Nacional Natural Chiribiquete, Río Cuñare – Raudal del tubo, Feb fr, *Fundación Biológica Puerto Rastrojo CHI-61* (K). **Venezuela.** AMAZONAS: Río Autana, afl. del Sipapo, Nov fr, *Cruxent 69* (VEN); Depto Atabapo, Río Atacavi, 3°12'N, 67°24'W, 100 m, Nov fr, *Velazco 1153* (MICH, MO, PORT); Depto Atabapo, Río Caname, a 1 km de la confluencia con el Río Atabapo, 3°41'N, 66°27'W, 95 m, Nov fr, *Yañez 118* (MICH, MO).

Byrsonima flexipes is named for its sigmoid-ascending pedicels. In the *Flora of the Venezuelan Guayana* (Anderson 2001a, p. 125) I treated this species as “*Byrsonima* sp. A.” My comments in that publication on its affinities are worth repeating here: “The species resembles *Byrsonima rodriguesii* W. R. Anderson, a plant from the vicinity of Manaus that differs in its longer stipules, glabrous sepals that are soon reflexed or revolute in the enlarging fruit, fruiting pedicels that are thicker and curved upward but not sigmoid, and larger fruits. The petals of the new species can be expected to be white turning red, as in *B. rodriguesii*, and for the same reason its anthers should have a large, glandular connective that extends well beyond flattened locules.” For an illustration of *Byrsonima rodriguesii*, see Fig. 3.

***Heteropterys aequatorialis* W. R. Anderson, sp. nov.**—TYPE: ECUADOR. Guayas: Capeira, 22 km N of Guayaquil, 2°S, 79°58'W, disturbed dry forest, 20–150 m, 15 Jul 1986 fl/fr, *A. Gentry & C. Dodson 54847* (holotype: MICH!; isotype: MO!). Fig. 4.

Liana lignosa, caulibus primo velutinis pilis V-formibus instructis; lamina foliorum majorum 2.5–7 (–9.2) cm longa, 1.5–4.5 (–5.2) cm lata, utrinque ± pertinaciter velutina pilis V-formibus, eglandulosa vel interdum margine prope basim biglandulosa; petiolus 3–6 (–12) mm longus, plerumque inter mediam et apicem biglandulosus; inflorescentia ex umbellis vel corymbis (3–) 4–5 (–10)-floribus constans, pedunculis 2–4 mm longis, bracteolas infra apicem ferentibus; sepala per anthesin appressa; petala flava, 4 lateraliter dorsaliter anguste carinata; stamina glabra, filamentis ca. 1/2-connatis; stigmata apice dorsaliter rotundata vel truncata; samara (17–) 20–30 mm longa, parce sericea, nux reticulo prominenti.

Woody vine, with stems up to 15 mm in diameter, initially velutinous with very short, coppery or occasionally golden, V-shaped hairs, soon or eventually glabrescent and developing many punctiform lenticels. Lamina of larger leaves 2.5–7 (–9.2) cm long, 1.5–4.5 (–5.2) cm wide, ovate or elliptical or rarely slightly obovate, obtuse to rounded at base, obtuse to rounded and usually apiculate at apex, eglandular or occasionally biglandular on edge near base, ± persistently velutinous above with very short V-shaped hairs or eventually glabrescent, persistently velutinous below with longer V-shaped hairs, the hairs occasionally becoming ± appressed in age or rarely deciduous, the principal lateral veins 5–7 pairs, obscure or sunken above, prominent below; petiole 3–6 (–12) mm long, velutinous like stem, usually bearing 2 large glands between middle and apex, sometimes eglandular; stipules 0.2–0.6 mm long, borne on upper edges of petiole just above base. Inflorescence paniculate, coppery- or golden-velutinous, the flowers borne in umbels or tight corymbs of (3–) 4–5 (–10); leaves in the inflorescence abruptly reduced and bearing larger glands; bracts 0.7–1.2 mm long, 0.5–0.7 mm wide, ovate or elliptical, abaxially appressed-tomentose, adaxially glabrous, eglandular, persistent; peduncle 2–4 mm long; bracteoles like the bracts but shorter, strongly appressed, eglandular or glandular-callose abaxially at base, borne below apex of peduncle (as low as the middle); pedicel 3.5–6 mm long. Flowers ca. 8–10 mm in diameter. Sepals 1–1.7 mm long beyond glands, 1–1.7 mm wide, triangular, obtuse

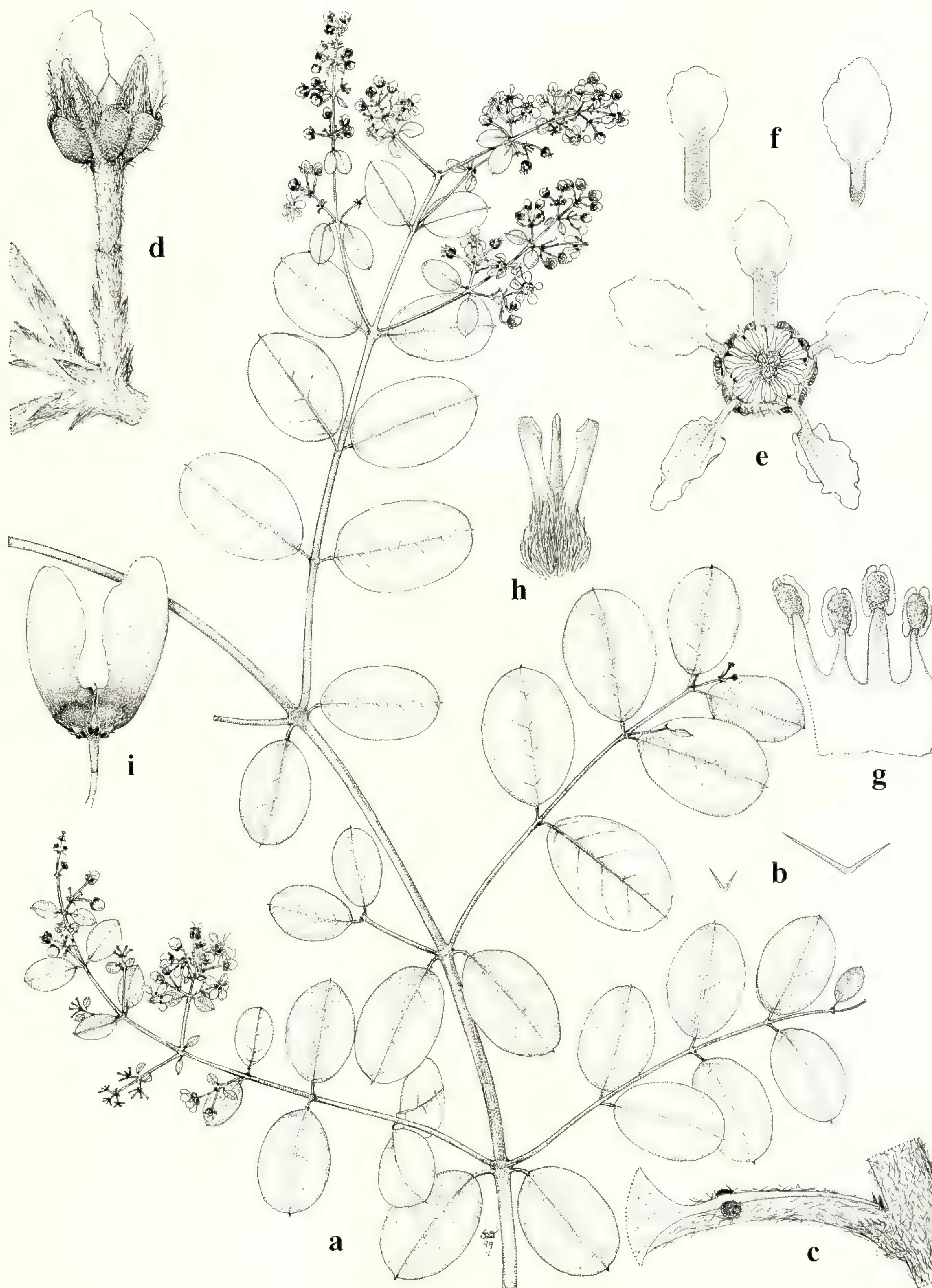


FIG. 4. *Heteropterys aequatorialis*. a. Flowering branch, $\times 0.5$. b. Hairs from adaxial leaf surface (left) and abaxial surface (right), $\times 20$. c. Petiole with basal stipules and distal glands, $\times 5$. d. Umbel showing one flower bud, $\times 5$. e. Flower from above with posterior petal at top, $\times 4$. f. Posterior petal (left) and posterior-lateral petal (right), $\times 4$. g. Part of androecium, abaxial view, with longer stamens opposite sepals, $\times 7.5$. h. Gynoecium, anterior style in center, $\times 7.5$. i. Fruit with only two of the three samaras developed, $\times 1$. Drawn by Karin Douthit. (Based on: a–c, *Madsen 63796*; d–h, *Harling 3002*; i, *Gentry & Dodson 54847*.)

at apex, loosely investing bud, appressed in anthesis, abaxially thinly or unevenly sericeous, adaxially glabrous, the anterior eglandular, the lateral 4 all biglandular, the glands 1.1–2 mm long, glabrous. Petals yellow turning orange or reddish in age, glabrous, eglandular on the margin; lateral petals spreading to reflexed, the claw 1–1.5 mm long, the limb 3–3.7 mm long, 2–3 mm wide, elliptical or rectangular, often slightly auriculate at base, entire, denticulate, or erose, $\pm$ concave to flat, abaxially narrowly carinate; posterior petal erect with the limb reflexed, the claw 1.5–2 mm long, 0.7–0.9 mm wide, the limb 2.3–3.3 mm long, 2–3 mm wide, elliptical to subcircular, entire or erose, $\pm$ flat, abaxially slightly carinate or smooth. Stamens glabrous; filaments 1.5–3 mm long, connate in the basal 0.8–1.5 mm, unequal, generally longer opposite sepals than petals; anthers glabrous, 0.7–1.2 mm long, subequal, reflexed in age, the connective glandular-swollen. Ovary 1–1.5 mm high, sericeous; styles 1.7–2.3 mm long, equal, straight, erect to divergent, terete or laterally $\pm$ flattened, rounded or truncate dorsally at apex, the stigma internal and circular or vertically elliptical. Samaras borne on a pyramidal torus 1.3–1.5 mm high, with a smooth yellow 3-lobed disc developing as fruits mature and evident only after samaras fall; samara (17–) 20–30 mm long, thinly sericeous with short, straight, strongly appressed hairs; dorsal wing (12–) 15–25 mm long, (5–) 8–12 mm wide, the abaxial edge bent abruptly or curved gradually upward; nut 5–6 mm long, 4.5–5.5 mm high, subconical to subsphaeroidal, unwinged on sides but with prominent reticulate veins.

Dry, deciduous forests in the Pacific lowlands of Ecuador and adjacent Peru, from sea level to 300 m; collected with flowers May–December and with fruits May–January.

ADDITIONAL SPECIMENS EXAMINED. **Ecuador.** EL ORO: Tumbus, Gulf of Guayaquil, Oct fl, *Barclay* 590 (BM, US).—GUAYAS: Island of Puná, Sep fl, *Barclay* 418, 477 (both BM); El Progreso along road between Salinas and Guayaquil, Nov fr, *Barfod et al.* 48253 (AAU); Km 21 Guayaquil–Daule, Sep fl/fr, *Dodson & Dodson* 11441 (MO); 9 km W of Cerecita on Guayaquil–Salinas toll road, Oct fr, *Gentry* 12268 (MICH, MO); type locality, Jul fl/fr, *Gentry & Dodson* 54790 (MICH, MO); Guayaquil, Sta. Ana, Oct fl, *Harling* 3002 (MICH, S); Guayaquil–Salinas Road, 1–5 km E of El Progreso, Jan fr, *Harling & Andersson* 21097 p.p. (GB [flowering branch = *Bunchosia plowmanii* W. R. Anderson]); 10 km N of Cerecita on road to Julio Moreno, May fl/imm fr, *Harling & Andersson* 25052 (GB, MICH); 3 km N of Julio Moreno (Simón Bolívar), May fl, *Harling & Andersson* 25026 (GB); Isla Puná, 2°45'–49'S, 79°55'–80°08'W: near Puná Nueva, Jun fl, *Madsen* 63563B (AAU, MICH), Campo Alegre to Puná Vieja, Jul fl, *Madsen* 63796 (AAU, MICH), El Placer toward Río Hondo, Sep fl, *Madsen* 63932 (AAU), vicinity of La Polvora and Concordia, Nov fl, *Madsen* 64118 (AAU); Guayaquil Cantón, Bosque Protector Cerro Blanco, carretera a Salinas Km 15, 2°10'S, 79°58'W, Aug bud, *Rubio et al.* 1908 (MICH); Cerro Bellavista, Cord. Colonche, Sep fl, *Valverde* 1800 (SEL).—**MANABÍ:** Near base of Montecristi, Dec fl, *Dodson & Thien* 1739 (WIS); Pepa de Huso near Portoviejo, Sep fl/fr, *Játiva & Epling* 986 (MO, NY, S, UC). **Peru.** TUMBES: S side of Quebrada Angostura (at Hualtaco) 8–10 km from El Caucho, Bosque Nacional de Tumbes, *Simpson* 505 (F, NY).

The epithet of this species denotes the fact that it is nearly endemic to Ecuador. *Heteropterys aequatorialis* belongs to a group of species characterized by appressed sepals, yellow petals, and well-developed peduncles with the bracteoles borne well below the apex. Within that group it goes with the species that bear glands on the petiole or on the *margin* of the lamina, never on the surface, and among those its sessile, V-shaped hairs suggest a relationship to *H. trichanthera* Adr. Juss. and *H. cochleosperma* Adr. Juss. *Heteropterys trichanthera* is a variable species (or species complex) from eastern Brazil (Piauí, Pernambuco, Bahia, Minas Gerais) that is immediately distinguished by its hairy anthers. *Heteropterys cochleosperma* (= *H. hassleriana* Nied.) is most common in Paraguay and adjacent Bolivia, but it

extends far into Brazil as well (Mato Grosso do Sul, Goiás, Minas Gerais, Bahia, São Paulo, Paraná). It differs from *H. aequatorialis* most obviously in its larger leaves with longer petioles bearing larger glands. Its lamina is usually soon glabrate and shining above, and (especially in the reduced inflorescence leaves) often bears several distal glands on the margin. The inflorescence is more open, with longer stalks bearing the umbels, and the stigma is usually dorsally apiculate at the apex. The nut of the samara is tomentose to glabrate and wrinkled when dry.

Heteropterys hammelii W. R. Anderson, sp. nov.—TYPE: COSTA RICA. Alajuela: Cantón de San Ramón, Pacífico Central, por el Río Barranca, camino a ICE planta electrica por Bajo Barranca, 1 km N de la Interamericana, 10°02'30"N, 84°34'02"W, 400 m, 31 Dec 1993 fl, *B. Hammel 19364* (holotype: MICH!; isotypes: INB! MO).

Liana lignosa; lamina foliorum majorum 3.5–9 cm longa, 2–5.5 cm lata, ovata, mox glabrata, interdum 2 glandulis peltatis in pagina abaxiali instructa; inflorescentia paniculata ex umbellis vel corymbis 2–6-floribus constans; bracteolae 0.5–0.6 mm longae, rotundatae, apicales; sepala glabra; petala rosea, 4 lateralia abaxialiter anguste carinata; styli divergentes, stigmatibus transverse ellipticis; samara 18–30 cm longa, ala dorsali 6.5–10 mm lata, alula laterali utrinque singulari, 2–4 × 4–5.5 mm.

Woody vine, the vegetative stems initially densely and loosely sericeous but very soon glabrescent to quite glabrous, developing many punctiform lenticels in age. Lamina of larger leaves 3.5–9 cm long, 2–5.5 cm wide, ovate, cuneate to rounded at base, acute, obtuse, or acuminate at apex, initially densely tomentose on both sides but soon glabrate or with some hairs persistent especially on abaxial midrib, usually bearing (0) 1 (2) peltate glands on each side of abaxial midrib on lateral veins between midrib and margin and within 20 mm of base, the glands with a stalk 0.2–0.5 mm long and a cap 0.4–0.8 mm in diameter, the principal lateral veins 4–7 pairs, prominent below; petiole 3–10 mm long, initially tomentose but soon glabrate, eglandular or occasionally bearing on distal half 1 or 2 glands like those of lamina; stipules absent or minute (0.1–0.2 mm long), borne on upper edges of petiole at base. Inflorescence paniculate, thinly tomentose to glabrate, the flowers borne in umbels or corymbs of 2–6; leaves in the inflorescence abruptly reduced and bearing very large abaxial glands up to 2 mm in diameter; bracts 0.8–1.1 mm long, 0.6–0.8 mm wide, lanceolate or ovate, glabrous or bearing a few abaxial hairs, eglandular, spreading; peduncle 1.5–2.3 mm long; bracteoles like bracts but shorter (0.5–0.6 mm long) and more rounded, eglandular or bearing 2 tiny glandular spots abaxially at base, borne at or just below apex of peduncle; pedicel 2.8–4 mm long, sparsely tomentose to glabrate. Flowers ca. 10 mm in diameter. Sepals 0.9–1.4 mm long beyond glands, 1.1–1.4 mm wide, ovate or triangular, rounded at apex, translucent and membranous at margin, loosely investing bud, erect in anthesis, glabrous, the anterior eglandular, the lateral 4 all biglandular, the glands 1.3–1.6 mm long, glabrous. Petals pink (or pink with white margins?) turning darker rose in age, glabrous; lateral petals spreading to reflexed, the claw ca. 1.5 mm long, the limb 3–3.5 mm long, 2.5–3 mm wide, obovate, ± decurrent onto claw, entire and eglandular, concave to nearly flat, abaxially carinate with the keel 0.1–0.2 mm wide; posterior petal erect with the limb spreading to horizontal, the claw ca. 3 mm long, ca. 0.9 mm wide, the limb 2.4–2.7 mm in diameter, subcircular, truncate or slightly auriculate at base, erose or denticulate,

eglandular but the proximal teeth sometimes thickened, somewhat crumpled, abaxially not or hardly carinate. Stamens glabrous; filaments 1.7–2.5 mm long, connate in the basal 0.5–1 mm, unequal, longest opposite anterior sepal, shortest opposite posterior petal, the posterior 3 slenderer than the other 7 and bent inward between 2 posterior styles; anthers 0.7–1.3 mm long, the posterior 3 shorter than the anterior 7, the connective mostly yellow, dark red around the margin. Ovary ca. 1 mm high, tomentose; styles 1.8–2.2 mm long, equal, straight or somewhat sigmoid and soon strongly divergent between stamens, nearly terete, triangular at apex and dorsally acute or blunt-tipped, the stigma internal and transversely elliptical. Samaras borne on a broad 3-sided torus ca. 1 mm high; samara 18–30 mm long; dorsal wing 15–25 mm long, 6.5–10 mm wide, loosely sericeous to glabrate; nut 3.5–5 mm long, 4–5 mm high, tomentose to glabrate, the sides with prominent reticulate veins and distally a single, usually undivided lateral winglet 2–4 3 4–5.5 mm.

Endemic to the Pacific lowlands of Costa Rica, in seasonally dry woodlands, 50–650 m; collected with flowers December–April and with fruits January–April.

ADDITIONAL SPECIMENS EXAMINED. **Costa Rica.** GUANACASTE: Comelco Property near Bagaces, open derived savannah, 50 m, Jan fl/fr, *Opler 519* (CR, F); forêts des collines de Nicoya, Feb fl, *Tonduz 13475* (CR, G, GH, K, US).—SAN JOSÉ: Cantón de Acosta, cuenca del Pirris-Damas, Valle del Candelaria, Río Candelaria, cerca camino a Ceiba Baja, 650 m, Apr fl/fr, *Morales 6163* (CR, INB); Vallée du Río Jarris, près de Pacaca, Jan fl, *Pittier 3259* (CR).

I am happy to name this species for Barry E. Hammel, b. 1946, indefatigable student of the flora of Costa Rica. *Heteropterys hammelii* belongs to a group of species with pink petals, glabrescent leaves, and stalked glands on the leaves that become very large on the reduced leaves in the inflorescence. It differs from all its relatives from Colombia to Mexico in its glabrous sepals; the others all have the sepals abaxially sericeous, at least on the proximal half. It is also notable for the single undissected lateral winglet on each side of the samara nut. In *H. standleyana* W. R. Anderson of northern Central America the nut is smooth-sided, and in *H. palmeri* Rose of western Mexico the nut bears, in the position of the lateral winglet of *H. hammelii*, an irregularly dissected row of outgrowths that is often double or triple. The apical bracteoles also help to distinguish *H. hammelii* from *H. palmeri* and from *H. lonicerifolia* Triana & Planch. of Colombia, in both of which the bracteoles are borne well below the apex of the peduncle.

Hiraea fosteri W. R. Anderson, sp. nov.—TYPE: PANAMA. Canal Zone: Barro Colorado Island, shore, first cove S of Colorado Pt., 23 May 1971 fl, *R. Foster 2296* (holotype: MICH!; isotypes: F! US!).

Liana lignosa, caulibus laxe sericeis pilis 1–2 mm longis, mox glabratis; lamina foliorum majorum 6–12 (–14) cm longa, 2.8–4.5 (–6) cm lata, elliptica vel parum obovata, basi cordata vel auriculata, margine distaliter glandulis cylindricis vel filiformibus instructa, apice acuminata, mox paene glabrata; petiolus 2.5–5.5 mm longus, eglandulosus vel apice biglandulosus glandulis usque ad 0.4 (–0.6) mm diametro; stipulae (1–) 1.5–3 (–4) mm longae, plerumque prope medium petioli portatae; inflorescentia ex umbellis 4-floris constans; pedicellus laxe sericeus pilis patentibus (0.8–) 1–1.5 mm longis; petala lateralia fimbriata vel laciniata, eglandulosa; petalum posticum glanduloso-fimbriatum vel -laciniatum; styli 3.5–5 mm longi, arcuati praecipue 2 posteriores; samara alis lateralibus 17–22 mm latis, 25–29 mm altis, laxe sericeis vel tomentosis.

Woody vine; stems initially loosely sericeous with hairs 1–2 mm long, soon glabrate. Lamina of larger leaves 6–12 (–14) cm long, 2.8–4.5 (–6) cm wide, elliptical or widest somewhat above middle, cordate or auriculate at base, bearing several small cylindrical (occasionally filiform) glands on distal 1/2–2/3 of margin, acuminate at apex, initially loosely but densely sericeous or appressed-tomentose on both sides, soon glabrate above with at most a few hairs persistent on midrib at very base, $\pm$ glabrescent below at maturity but usually tightly sericeous proximally on midrib and often with much longer (1–2 mm) and looser hairs $\pm$ persistent on midrib distally, the principal lateral veins 7–10 pairs, prominent below but not above, interconnected by tertiary veins that are parallel or not, not especially close together and not all at 90° to midrib; petiole 2.5–5.5 mm long, sericeous or appressed-tomentose, eglandular or bearing 2 small knoblike glands up to 0.4 (–0.6) mm in diameter at apex; stipules (1–) 1.5–3 (–4) mm long, subulate, sericeous, usually borne at middle of petiole or slightly above or below but occasionally nearer base, straight or decurved. Inflorescence a solitary axillary cyme of three 4-flowered umbels, the lateral branches sometimes not developing and the inflorescence then a single stalked 4-flowered umbel; umbel without a gland in center, each borne on a loosely sericeous or tomentose stalk 3–11 mm long; bracts 1.5–2 mm long, 1.2–1.8 mm wide, ovate and boatshaped, abaxially sericeous, adaxially glabrous, eglandular, persistent; bracteoles like bracts or smaller, especially narrower; pedicel 16–20 mm long (–23 mm in fruit), very loosely sericeous with spreading, mostly straight hairs (0.8–) 1–1.5 mm long. Sepals 2–3.5 mm long, 1.5–2.5 mm wide, ovate or elliptical, obtuse or rounded at apex, appressed in anthesis, abaxially densely appressed-tomentose or loosely sericeous, adaxially glabrous, the anterior eglandular, the lateral 4 eglandular or biglandular, the glands when present 1–2 mm long, circular or elliptical, separated from each other, distinctly stalked. Petals yellow with (at least in the posterior petal) red in center of limb, glabrous; lateral 4 petals $\pm$ spreading, with the claw 2–3 mm long, the limb 5–6.5 mm long, 5.5–8 mm wide, circular or transversely elliptical, somewhat concave, fimbriate to short-laciniate all around margin with the divisions eglandular; posterior petal nearly erect, the claw 2.5–4 mm long and thicker than in lateral petals, the limb 4.5–7 mm long and wide, flat and $\pm$ circular, fimbriate or short-laciniate all around margin with the divisions $\pm$ glandular-thickened. Stamens glabrous; filaments connate for 0.6–1 mm, longer opposite sepals (3–5 mm) than opposite petals (2.3–4.5 mm), the shortest 3 opposite posterior 3 petals, straight to strongly bowed, especially those opposite the 2 posterior-lateral sepals; anthers 0.7–1.1 mm long, $\pm$ similar to each other, the locules separated on a massive red glandular connective. Ovary ca. 1 mm high, densely dark-brown-tomentose or hispid; styles 3.5–5 mm long, all bowed outward and then back toward center of flower but the posterior 2 much more strongly bowed than the anterior, all laterally flattened distally, with a short acute dorsal hook at apex, the stigma internal. Samara butterfly-shaped; lateral wings membranous, 17–22 mm wide, 25–29 mm high, semi-circular to almost elliptical, sinuous to rounded-erose, loosely sericeous or tomentose (to eventually glabrescent?) with spreading hairs 1–1.5 mm long or longer; dorsal wing 2.5–3.5 mm wide, 3–4 mm high, irregularly sharp-toothed, hispid like the nut; nut $\pm$ globose, 3–3.5 mm in diameter, hispid with straight basifixed or sub-basifixed hairs ca. 2–3 mm long.

Lowlands of Panama; collected with flowers and fruits in April and May.

ADDITIONAL SPECIMENS EXAMINED. **Panama.** CANAL ZONE: Barro Colorado Island, shoreline from small island N of Barrunga Point W to Drayton House, May fl, *Croat* 5728 (MO); near Fort Randolph, low hilly woods, May fr, *Maxon & Harvey* 6529 (GH).—COLÓN: Strand vegetation along beach ca. 3

mi SW of Colón, Apr fl, *Croat 14163A* (MO); disturbed ravine above Guaira (mainland opposite Isla Grande), Apr fl, *D'Arcy 4049* (MO).—DARIÉN: Manene to mouth of Río Coasi, Apr fl/fr, *Kirkbride & Bristan 1444* (NY).

Hiraea fosteri is named in honor of Robin B. Foster, b. 1945, who has had a distinguished career in neotropical botany. The type and all the paratypes except that collected by Kirkbride & Bristan were cited in the *Flora of Panama* (Cuatrecasas & Croat 1981) as *Hiraea reclinata* Jacq., but *H. fosteri* is easily separated from *H. reclinata*. *Hiraea reclinata* has leaves that are mostly obovate and obtuse to rounded or emarginate at the apex, the fine reticulum is $\pm$ white against dark areoles on the abaxial side of the dried lamina, the petiole glands are larger, the hairs of the pedicel and samara wings are tightly appressed, and the divisions of the posterior petal are never glandular-thickened. When it has glands on the lamina margin they are sessile buttons, not the cylindrical or filiform glands of most specimens of *H. fosteri*. I have been unable to find any other name in Central or South America that could be applied to this species, for which reason I have concluded that it must be undescribed.

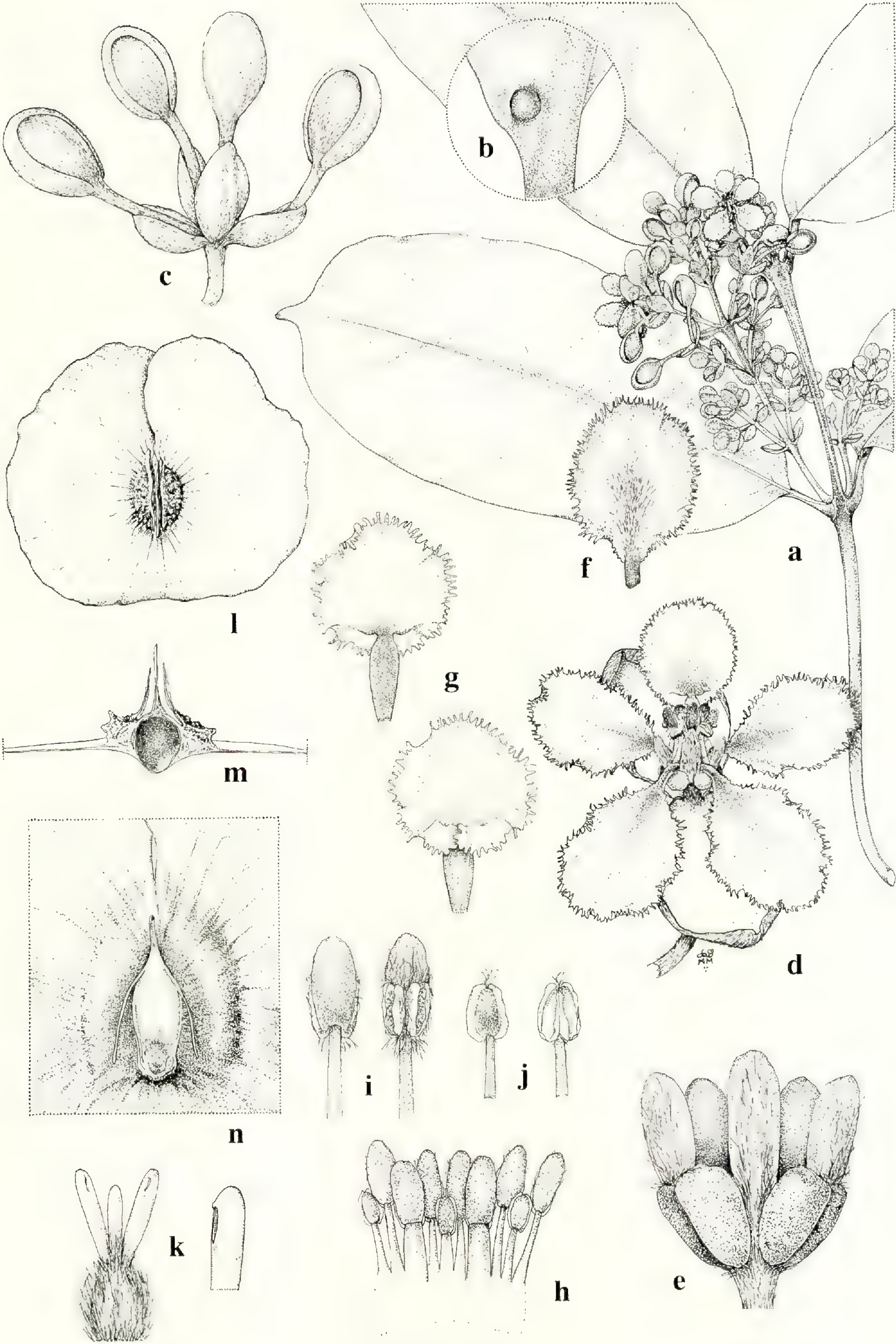
Of the specimens cited above, *Croat 5728* and *Kirkbride & Bristan 1444* have all the sepals eglandular; the others have the lateral sepals biglandular.

Mezia russellii W. R. Anderson, sp. nov.—TYPE: PERU. Loreto: Loreto, Nauta, carretera Nauta-Iquitos, bosque primario, 4°29'S, 73°35'W, 150 m, 9 Jan 1988 fl, *R. Vásquez & N. Jaramillo 10301* (holotype: MICH!). Fig. 5.

Liana lignosa; lamina foliorum majorum 14–16.3 cm longa, 7–9 cm lata, glabrata; petiolus 13–17 mm longus; bracteae 7–8 mm longae, per anthesin persistentes; bracteolae 9–12 mm longae, eglandulosae; sepala glandulas 1–2 (–2.4) mm superantia, 1–1.1 mm lata, $\pm$ plana, abaxialiter hirsuta pilis albidis rectis, glandulis distinctis; petala lateralia plana fimbriata; petalum posticum limbo circulari, basi auriculato lobis superpositis; filamenta petalis postico-lateralibus opposita crassissima; antherae sepalis oppositae dense hirsutae; styli recti, obtusi, stigmatibus internis anguste ellipticis; samara 67–90 mm lata et 55–80 mm alta, ala laterali basi continua.

Woody vine; stems initially brown-sericeous, soon glabrate. Lamina of larger leaves 14–16.3 cm long, 7–9 cm wide, elliptical or slightly obovate, broadly obtuse or rounded at base, thickened and slightly revolute at margin, rounded and abruptly short-acuminate at apex with the acumen 8–12 mm long, nearly glabrous at maturity (some leaves with a few short appressed hairs on abaxial midrib), abaxially bearing 1 large gland 1–2 mm in diameter at base on each side of midrib, often sunk in a crypt, and a single row of ca. 5–7 small (0.3 mm in diameter) impressed glands in a row within 1 mm of margin on distal half, the reticulum and ca. 5 pairs

FIG. 5. *Mezia russellii*. a. Flowering branch, $\times 0.5$. b. Abaxial base of lamina with large gland, $\times 5$. c. Umbel in bud, the bracts and bracteoles not yet full-sized, $\times 1.5$. d. Flower subtended by persistent bracteoles, posterior petal at top, $\times 2.5$. e. Calyx, anterior sepal in center, $\times 7.5$. f. Posterior-lateral petal, abaxial view, $\times 2.5$. g. Posterior petal, adaxial view (left) and abaxial view (below), $\times 3.5$. h. Androecium laid flat, abaxial view, the stamen to right opposite anterior sepal, $\times 5$. i. Anthers from stamens opposite sepals, abaxial view (left) and adaxial view (right), $\times 7.5$. j. Anthers from stamens opposite anterior-lateral petals, abaxial view (left) and adaxial view (right), $\times 7.5$. k. Gynoecium with anterior style in center (left, $\times 5$) and apex of single style, side view (right, $\times 7.5$). l. Samara, abaxial view, $\times 0.5$. m. Nut of samara in cross-section, with lateral wing truncated, $\times 1$. n. Ventral areole of nut of samara, $\times 1.5$. Drawn by Karin Douthit. (Based on: a–k, *Vásquez & Jaramillo 10301*; l–n, *Vásquez & Jaramillo 10429*.)



of principal lateral veins prominulous above, prominent below; petiole 13–17 mm long, sparsely sericeous to glabrate at maturity, eglandular; stipules not seen. Inflorescences terminal and axillary, persistently light-brown-sericeous or patchily glabrescent, branched, the flowers ultimately borne in 4-flowered umbels; floriferous bracts 7–8 mm long, ca. 6 mm wide, broadly elliptical, broadly rounded at apex and deeply concave, eglandular, abaxially densely light-brown-sericeous or patchily glabrescent and with the midrib slightly raised, adaxially glabrous, persistent through flowering, deciduous in fruit; peduncle 11–12 mm long in flower, thickened and slightly elongated in fruit, light-brown-sericeous; bracteoles 9–12 mm long, 9–11 mm wide, broadly elliptical and deeply concave to hemispherical, broadly rounded at apex and often tearing down the middle in age, eglandular, abaxially densely light-brown- or brown-sericeous and with the midrib raised, adaxially glabrous, persistent past maturity of fruit; pedicel ca. 1.3 mm long in flower, ca. 2.5 mm long in fruit, hirsute with the whitish or stramineous hairs appressed. Sepals 1–2 (–2.4) mm long beyond glands, 1–1.1 mm wide, spatulate, erect in anthesis, flat or slightly concave, abaxially densely appressed-hirsute except toward margins and apex with the hairs whitish or stramineous, stiff, and straight, adaxially glabrous, the anterior eglandular, the lateral 4 biglandular with the glands 7–9 mm long, 1–1.5 mm wide, obovate, compressed but not at all connate. Petals yellow, smooth (not crumpled), fimbriate all around margin, the fimbriae slightly glandular-thickened, especially on posterior petal; lateral petals abaxially white-sericeous in center with the hairs $\pm$ straight, very fine, strongly appressed, the claw 1–2 mm long, the limb 7–9 mm long, 6–8 mm wide, obovate, the anterior pair larger and longer-clawed than the posterior pair; posterior petal glabrous, the claw 3.3 mm long, thick, constricted at apex, the limb 5–6 mm in diameter, orbicular and deeply auriculate at base with the lobes overlapping abaxially (behind the claw). Filaments glabrous, connate in the basal 1–1.5 mm, erect and straight or reflexed distally, strongly heteromorphic, 2.5–3.5 long, shortest opposite anterior-lateral and posterior petals, longest opposite sepals, almost as long opposite 2 posterior-lateral petals and 0.7 mm wide, much wider than all others; anthers with the connective abaxially dark red proximally and yellow distally, heteromorphic: 5 opposite sepals 1.7–2 mm long, densely hirsute on locules, the connective extended well beyond locules; 5 opposite petals bearing tufts of only a few hairs at base or base and apex and otherwise glabrous, the locules not exceeded by connective, the 3 opposite anterior-lateral and posterior petals 1–1.2 mm long, the 2 opposite posterior-lateral petals 1.5–1.8 mm long. Ovary 1.5 mm high, densely sericeous; styles nearly terete, straight, erect to divergent, the anterior ca. 2 mm long and sericeous on proximal half, the posterior 2 ca. 2.5 mm long, stouter than anterior, sericeous only at base, all 3 obtusely rounded at apex with the stigma apparently narrowly elliptical on the internal angle. Samara circular or somewhat oblate, 67–90 mm wide, 55–80 mm high, finely and tightly brown-sericeous with the very short hairs much denser on nut than wings; lateral wing 30–37 mm wide, continuous at base, deeply incised at apex to where both lobes fuse with central dorsal winglet, membranous, nearly flat except near nut, entire or repand at margin, the lobes overlapping; central dorsal winglet 8–10 mm wide, 25 mm high, roughly semicircular, often repand, flat; 2 lateral dorsal winglets parallel to central dorsal winglet, generally like it and almost as large, connected to lateral wing by a mass of irregular ruffles overlying aerenchyma; nut outside lateral wing without ribs or winglets, the ventral areole 11–12 mm high, 4.5 mm wide, narrowly ovate, bordered by 2 ribs that usually remain on samara.

ADDITIONAL SPECIMEN EXAMINED. **Peru.** MAYNAS: Iquitos, Nina rumi, bosque primario, suelos con un poco de arena blanca, 3°48'S, 73°25'W, 122 m, 4 Feb 1988 fr, *Vásquez & Jaramillo 10429* (MICH).

The epithet of *Mezia russellii* honors the memory of my son, Russell William Anderson (1972–1999). It is known only from the two collections cited above, and the flowers on the holotype are few and damaged by insects. Nevertheless, the species is very distinctive. Its short flat sepals with straight whitish hairs are unique in the genus; other species have the sepals 2–4 times as long, abaxially reddish- or brown-tomentose, and often revolute along the sides. Other diagnostic characteristics are the large, persistent bracts, the smooth and fimbriate lateral petals, the auriculate-based posterior petal with the lobes overlapping behind the claw, the very thick filaments opposite the posterior-lateral petals, the densely hairy locules of the anthers opposite the sepals, and the straight obtuse styles with elongated internal stigmas. The straight styles and glabrous leaves suggest that the closest relatives to *M. russellii* are to be sought in *M. includens* (Benth.) Cuatrec. sens. lat. and *M. curranii* W. R. Anderson, but both differ in most of the characters given above.

ACKNOWLEDGMENTS

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MONOGRAPH OF LOPHOTERYYS (MALPIGHIACEAE)

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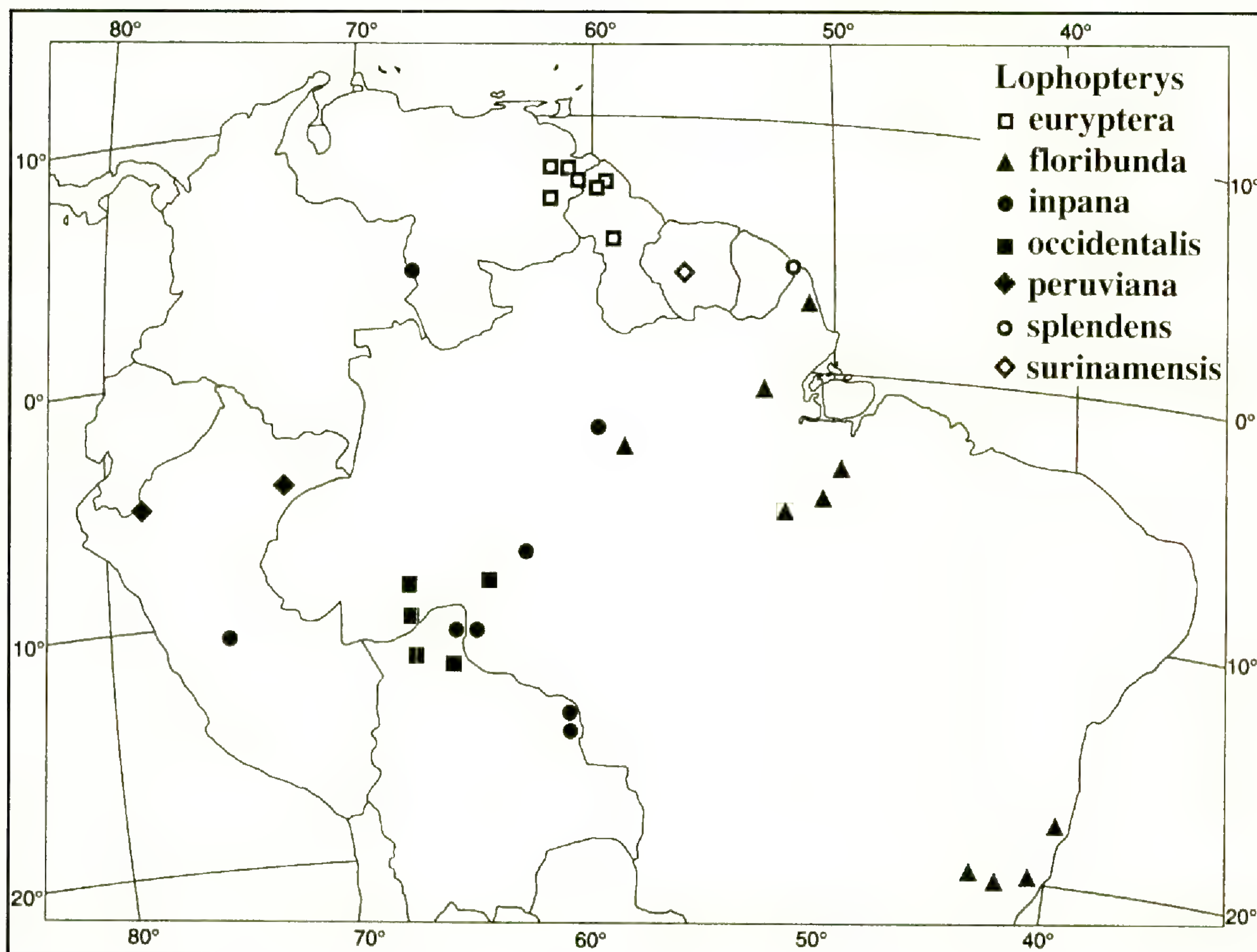
ABSTRACT. *Lophoterys* Adr. Juss. is a South American genus of Malpighiaceae comprising seven species, two of which are described here as new (*L. floribunda* W. R. Anderson & C. C. Davis and *L. occidentalis* W. R. Anderson & C. C. Davis). The taxonomic history, morphology, circumscription, and systematic position of the genus are discussed, with the conclusion that while the genus is coherent and easily recognized, its relationships in the family are still somewhat obscure. The taxonomy is revised with descriptions, keys, and notes on phenology, habitat, and distribution, and all specimens studied are cited. Illustrations include a distribution map, SEMs of pollen from two species, and drawings of six species.

INTRODUCTION

Lophoterys is a small South American genus of Malpighiaceae, which as recently as 1951 seemed to be wholly restricted to the Guianas. We now know that the genus is widespread (Fig. 1), with collections known not only from the Guianas, but also from Amazonian Venezuela, Peru, Bolivia, and Brazil, and from extra-Amazonian southeastern Brazil. Our purpose in this paper is to review the history, circumscription, and possible relationships of the genus, and to offer a taxonomic revision of the known species.

TAXONOMIC HISTORY

The genus *Lophoterys* was described by Adrien de Jussieu (1838) on the basis of a fruiting collection by Poiteau from somewhere in French Guiana, which Jussieu called *Lophoterys splendens*. The generic name means “crest-wing” and refers to the fact that each mericarp in the type species bears only a dorsal crest (see Fig. 7g). The specific epithet, meaning shining or brilliant, undoubtedly referred to the persistently metallic-sericeous abaxial leaf surface. Jussieu noted the fact that each of the four lateral sepals bore one large gland, instead of the paired glands found in most neotropical Malpighiaceae. When he published his monograph of the family in 1843, Jussieu gave a more complete description of the species and placed the genus in his tribe Banisterieae, which comprised genera with the dorsal wing dominant. He then went on to say that the affinity of the genus was doubtful, adding that it resembled several genera in some characters but other characters made all those relationships unlikely, and concluded with the curious suggestion that it was perhaps closest to *Pterandra*.

FIG. 1. Distribution of *Lophopterys*.

Nieden zu (1928) also placed *Lophopterys* among the neotropical genera with the dorsal wing dominant, in his subtribe Banisteriinae. The only material he saw was the Poiteau type, to which he gave the superfluous name *L. splendens* var. *oblanceolata* Nied., and two flowering collections from British Guiana [now Guyana] of what he called *L. splendens* var. *obovata* Nied.

In 1935 Kostermans described as the new genus *Dolichopterys* a species from Suriname, to which he gave the name *D. surinamensis* Kosterm. His material resembled *Lophopterys splendens* in most respects, but each mericarp of its fruit bore, in addition to the dorsal wing, two long narrow lateral wings toward the apex of the nut (Fig. 8b). Kostermans suggested that *Dolichopterys* [the name means "long-wing"] evolved from an ancestor in *Tetrapteryx* or *Triopteryx* that lost the lower lateral wing(s) found in those genera, and that *Lophopterys* was in turn derived from *Dolichopterys* through loss of the upper lateral wings, with only the dorsal crest retained.

Sandwith (1951) described as *Lophopterys euryptera* the taxon of British Guiana that Nieden zu had treated as *L. splendens* var. *obovata*. Sandwith had fruits, which resembled those of *Dolichopterys surinamensis*, so he knew that Nieden zu's assignment of the specimens from British Guiana to a variety of *L. splendens* was inappropriate. He argued that the fruit difference alone did not justify the recognition of two genera, so he proposed the combination *L. surinamensis* (Kosterm.) Sandwith. Thus, at that time the genus *Lophopterys* comprised three species, one endemic to each of the Guianas: *L. euryptera* in British Guiana, *L. surinamensis* in Suriname, and *L. splendens* in French Guiana. Sandwith discussed the possible

affinities of *Lophopterys* and generally supported Kostermans's comparison with *Tetrapterys* spp. because of the long narrow lateral wings on the samara, but cautioned that in other characters *Lophopterys* was so unlike *Tetrapterys* that the relationship was by no means certain.

In 1981 W. Anderson pointed out that *Lophopterys euryptera* occurs also in Venezuela, and provided a key to distinguish *L. euryptera* and *L. surinamensis*. Since then he has described two species from the interior of South America, *L. inpana* (1990b) and *L. peruviana* (1993). The present study adds descriptions of two new species and makes the first attempt to consider the genus as a whole since Sandwith's 1951 paper.

MORPHOLOGY, CIRCUMSCRIPTION, AND SYSTEMATIC POSITION OF THE GENUS

The genus *Lophopterys* is unusually homogeneous in a whole suite of characters that are traditionally important in the systematics of the Malpighiaceae. The plants are mostly woody vines of lowland forests, with persistently sericeous stems. The lamina is always densely and persistently sericeous on the abaxial surface, a feature known in other neotropical Malpighiaceae but not generally so conserved across an entire group of closely related species. There are either no glands on the lamina or at most two small glands on the margin near the base. Stipules are mostly absent, and only vestigial when present. The flowers are always borne in elongated pseudoracemes, although the branching of the inflorescence varies. In most characters the flowers fit the standard pattern found in the large majority of climbing neotropical Malpighiaceae (W. Anderson 1979)—yellow petals, ten stamens without strong differentiation of the anthers, three carpels with separate styles which are stigmatic on the internal angle—and thus are not very informative about relationships of the genus. While the characters above, taken together, can help to identify the genus, they tell us relatively little about the position of the genus in the family. Below we shall discuss in more detail the calyx glands, pollen, and unique fruits, which one might reasonably expect to shed light on the origin and relationships of *Lophopterys*.

The most noteworthy apomorphy of *Lophopterys*, aside from the distinctive fruit, is the usual presence on each of the four lateral sepals of one very large, radially lineate gland, presumably the result of the complete fusion of the paired abaxial glands found on the lateral sepals of most neotropical Malpighiaceae. Those calyx glands are a constant feature of *Lophopterys*; the only exception is the few populations of *L. inpana* that have lost the glands entirely. Therefore, it seems likely that the ancestor of the genus already had such glands, and if such a rare apomorphy were to be shared with other clades one would hope to have that tell us which are likely to be the closest sister genera. There are, in fact, two other genera of Amazonian Malpighiaceae in which such partial to complete fusion of the calyx glands is common. One is *Jubelina* Adr. Juss. in Deless. (W. Anderson 1990a, 2001); the other is *Mezia* Schwacke ex Nied. in Engl. & Prantl (W. Anderson 2001). All but one species of *Jubelina* have the calyx glands consistently completely connate, while the species of *Mezia* vary from having all the glands distinct to having them partially to completely connate. Unfortunately, in neither *Jubelina* nor *Mezia* do other aspects of the morphology support a close relationship to *Lophopterys*. In both, characters of vesture, leaf glands, inflorescences,

styles, and fruits are so different from *Lophopterys* that we must conclude that the fusion of the calyx glands probably occurred independently in the three genera (as is suggested by the existence of species with distinct glands in both *Jubelina* and *Mezia*). The calyx glands, while a very useful generic character for *Lophopterys*, do not seem to reveal anything about its position in the family.

The pollen of the Malpighiaceae falls into two broad classes, radially symmetrical (with the ectoapertures oriented at right angles to the equator) and globally symmetrical (without identifiable equator or poles and the apertures variously oriented). Previous authors have suggested that radially symmetrical pollen is plesiomorphic in the family, on the basis of the common occurrence of similar pollen in other rosoid families (e.g., Lowrie 1982; W. Anderson 1990c), and a recent molecular study (Davis et al., in press) has confirmed that globally symmetrical pollen is derived in the family and evolved once. *Lophopterys* has the derived, globally symmetrical type of pollen, with 12 or more ectoapertures (rugae in the terminology of Lowrie) oriented more or less at right angles to each other, and typically with endoapertures (pores) associated with six of the rugae, but not necessarily in the center of the ruga and not in an obviously consistent pattern (Lowrie 1982; see our Fig. 2). Such pollen is what we would expect in *Lophopterys*, because almost all genera of wing-fruited vines have globally symmetrical pollen. However, Lowrie (1982, p. 120) stated that the specific characteristics of the pollen of *Lophopterys* were not informative in assessing its relationships within that very large clade, and we have to agree. The pollen in this genus reinforces its placement among the many genera of neotropical vines with winged fruits, but is otherwise uninformative.

With the exception of *Lophopterys splendens*, which is discussed separately below, the samaras are similar in all the species of *Lophopterys*. The nut is spheroidal; there is a large, inequilaterally trapezoidal dorsal wing with its greatest width toward the base of the nut; and there are two long, narrow lateral wings borne toward the apex of the nut and pointed upward (see, for example, Figs. 4g and 5g). The lateral wings are oriented at an angle of about 45–60° to the dorsal wing. The genus can be divided into a group of three species with large samaras (*L. euryptera*, *L. peruviana*, and *L. surinamensis*) and a group of three with small samaras (*L. floribunda*, *L. inpana*, and *L. occidentalis*), but except for size the samaras are qualitatively very much alike in all six species. That samara is unique in the family. The only genus with a samara resembling that of *Lophopterys* is *Tetrapteryx* Cav., in which each samara bears four elongated lateral wings, with the upper two usually longer than the lower two. In some species of *Tetrapteryx* the lower wings are much reduced, and in at least one (*T. diptera* Cuatrec., of Colombia) they are completely lost and the samara bears a strong superficial resemblance to that of *Lophopterys*. However, the single large calyx glands of *Lophopterys* are unknown in *Tetrapteryx*, the dorsal wing, even when relatively large, never approaches the size or peculiar shape of that in *Lophopterys*, and in the group with fruits most like those of *Lophopterys* (section *Tetrapteryx*) the inflorescence and stipules are wholly different. None of this rules out the possibility that *Lophopterys* and *Tetrapteryx* shared a common ancestor with long narrow lateral wings, but nothing in the morphology except the samara's lateral wings supports that possibility.

The type of the genus, *Lophopterys splendens*, has a mericarp that is quite different from the samaras of the other species. The lateral wings are absent,

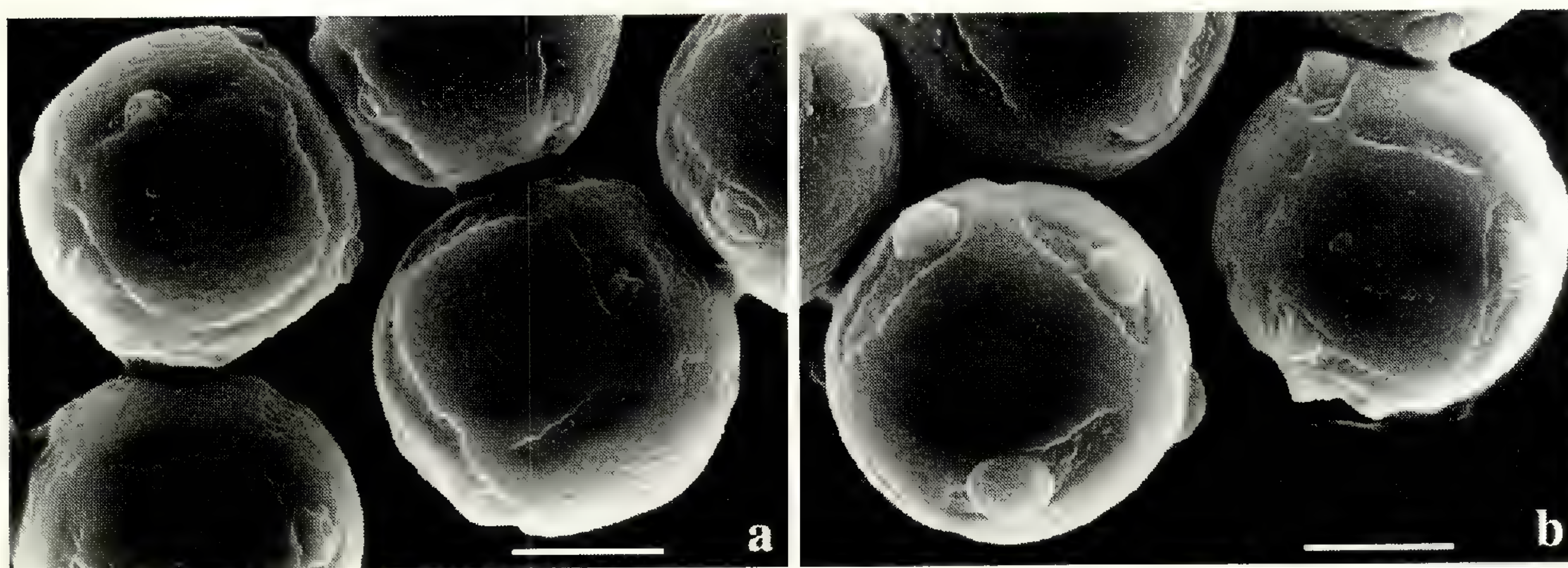


FIG. 2. Pollen of *Lophopterys*. a. *L. occidentalis* (Maguire et al. 56702). b. *L. inpana* (Morawetz & Wallnöfer 13-10988). Scale = 10 μ m.

represented at most by ribs where they “should” be; the nut is ellipsoidal, not spheroidal; and the dorsal wing is a mere crest, rather than the large trapezoidal wing of the other species. The fruit is so different, in fact, that one can fairly ask whether we are correct to put them in the same genus; perhaps Kostermans was justified in erecting the genus *Dolichopterys* for the species with lateral wings. On the other hand, all the other characters of *L. splendens*—indument, inflorescence, calyx glands, androecium, and gynoecium—support a close relationship to the other species treated here, especially the species of the Guianas. We conclude that *L. splendens* is best treated with the group from which it very likely originated by reduction of the fruits, just as C. Anderson (1997) kept the segregate *Brachypterys* Adr. Juss. in *Stigmaphyllon* Adr. Juss.

Two recent molecular studies (Cameron et al., in press, and Davis et al., in press) sequenced two different pairs of chloroplast genes from material representing most of the genera of the Malpighiaceae to infer phylogenetic relationships within the family. *Lophopterys* was represented by *L. floribunda*, which was placed, but without significant support, as sister to a clade containing *Malpighia*, *Mascagnia* sens. str., *Triopterys*, and a group of Old World genera with lateral-winged samaras. There was no support in those trees for associating *Lophopterys* with *Tetrapteryx*. The weak support for its placement as sister to the “malpighioids” suggests that *Lophopterys* may well move elsewhere in the family tree. Davis (unpublished) has recently assembled a phytochrome (*PHYC*) nuclear data set for the Malpighiaceae. The phytochrome gene family (*PHYB*) has been particularly informative within grasses (Mathews et al. 2000), resolving 67% of the nodes with bootstrap values of >91%. These data, when combined with the existing *ndhF* data set, resolve many of the relationships among the enigmatic wing-fruited taxa. In these analyses, *Lophopterys* is weakly placed as sister to *Hiraea fagifolia* (DC.) Adr. Juss. in a well-supported clade (i.e., 80% bootstrap) that also includes *Mascagnia hippocrateoides* (Triana & Planch.) Nied. and *Mascagnia dipholiphylla* (Small) Bullock. Placement with those taxa, all of which have a butterfly-shaped samara with two distinct lateral wings, seems much more reasonable than a putative relationship with *Mascagnia* sens. str. and its relatives, which have a single continuous lateral wing. This does not definitively resolve the problem of the position of *Lophopterys* among the neotropical wing-fruited clades, but 158 years after Jussieu first discussed the affinities of *Lophopterys* we are making significant progress toward solving the puzzle posed by this beautiful and distinctive little genus.

TAXONOMY

Lophopterys Adr. Juss. in Deless., Icon. Sel. Pl. 3: 18. 1838.—TYPE: *Lophopterys splendens* Adr. Juss.

Dolichopterys Kosterm., Recueil Trav. Bot. Néerl. 32: 279. 1935.—TYPE: *Dolichopterys surinamensis* Kosterm. [= *Lophopterys surinamensis* (Kosterm.) Sandwith].

Woody lianas or shrubs (or small trees?); stems densely, tightly, and persistently sericeous and often flattened or quadrangular when young, sometimes glabrescent in later years and becoming terete through secondary growth. Leaves opposite or subopposite; lamina densely and persistently sericeous below, mostly eglandular, occasionally biglandular on margin at base; stipules absent or vestigial, 0.2–0.5 mm long, borne on adaxial edges of petiole 1–2 mm above base. Inflorescence paniculate, rarely simple, the flowers ultimately borne in pseudoracemes with the flowers proximally decussate but distally mostly in no regular order, sometimes decussate, sometimes in whorls of 3 or 4; bracts and bracteoles mostly eglandular and adaxially glabrous (except in some populations of *L. inpana*), the bracteoles borne at apex of peduncle when peduncle is developed. Flowers with pronounced bilateral symmetry. Sepals 5, abaxially sericeous or tomentose, adaxially glabrous, the anterior sepal eglandular, the 4 lateral sepals usually each bearing a single, very large, circular or transversely elliptical, radially lineate abaxial gland. Petals 5, yellow, glabrous or only very sparsely sericeous abaxially; lateral petals reflexed; posterior petal with the claw erect and the limb erect to reflexed. Receptacle glabrous. Stamens 10; filaments glabrous, longer opposite sepals than petals, erect and nearly straight to reflexed distally; anthers $\pm$ alike, the connective not enlarged distally, the locules parallel, linear, $\pm$ membranous along edges; pollen globally symmetrical, with 12 or more non-equatorial, polyhedrally disposed rugae and typically 6 pores randomly associated with some of the rugae. Ovary of 3 distinct carpels, 1 anterior and 2 posterior, all fertile, 1–1.5 mm high, densely sericeous; styles 3, stout, the anterior shorter than the posterior 2, the stigmas large, borne on internal angle of apex. Fruit breaking apart into 3 samaras borne on a short pyramidal torus, each bearing a relatively short, inequilaterally trapezoidal or flabellate dorsal wing with its greatest width toward base of nut and 2 long, narrow, forward-pointing lateral wings 3 or more times as long as wide (except *L. splendens*, which has a narrow dorsal crest and the lateral wings reduced to ridges or lost). Embryo spheroidal, with one cotyledon folded upward distally around the other, the inner cotyledon often also folded back on itself distally.

The measurements given below for the dorsal wing of the samara follow the convention used by W. Anderson in 1981 (p. 26), with “width” denoting the distance from the nut to the farthest margin and “height” the maximum measurement at right angles to the width.

KEY TO THE SPECIES OF LOPHOPTERYS, FOR SPECIMENS WITH FLOWERS

1. Anther locules pilose with obvious spreading hairs.
 2. Peduncle 0.5–2.5 (–3) mm long; pedicel 2–4 mm long; hairs brown or dark brown throughout the inflorescence. *L. floribunda*.
 2. Peduncle (2–) 2.5–4 mm long, with at least some peduncles in every inflorescence 2.5 mm long or longer; pedicel 3.3–5 (–6) mm long; hairs golden-brown or golden on ultimate axes of inflorescence, especially peduncles and pedicels. *L. occidentalis*.

1. Anther locules glabrous.
3. Peduncle 1–9 mm long; axis of pseudoraceme up to 2 mm in diameter in flower; pedicel up to 1.5 mm in diameter at apex.
4. Abaxial surface of dried lamina metallic-sericeous with a bronze to golden sheen; inflorescence axes reddish brown; peduncle 1.7–9 mm long; bracts and bracteoles strongly spreading; bracteoles 1.5–3 mm long, 1–2.3 mm wide. *L. inpana.*
4. Abaxial surface of dried lamina with a matte finish, the very tight vesture not obvious but giving a gray or silvery aspect; inflorescence axes golden or brown; peduncle 1–2 mm long; bracts and bracteoles appressed or spreading at apex; bracteoles 0.8–1 mm long, 0.5–1 mm wide. *L. peruviana.*
3. Peduncle absent or up to 1 mm long in fruit; axis of pseudoraceme 1.5–4 mm in diameter in flower; pedicel at least 2 mm in diameter at apex.
5. Lamina abruptly acuminate at apex; bracts in distal half of pseudoraceme 2.7–5 mm long; pedicel 8–12 mm long. *L. splendens.*
5. Lamina broadly truncate or rounded to emarginate and often apiculate at apex; bracts in distal half of pseudoraceme 2–3 mm long; pedicel 3–8 mm long.
6. Petiole of larger leaves 20–60 mm long; lamina of larger leaves 10–23 cm wide, very tightly sericeous below. *L. euryptera.*
6. Petiole of larger leaves 15–20 mm long; lamina of larger leaves 8–10 cm wide, loosely sericeous below. *L. surinamensis.*

KEY TO THE SPECIES OF LOPHOPTERYS, FOR SPECIMENS WITH FRUITS

1. Lateral wings absent from samara. *L. splendens.*
1. Lateral wings present on samara.
2. Lateral wings of samara 45–62 mm long, 6.5–18 mm wide; dorsal wing of samara 10–20 mm wide, 19–30 mm high; nut of samara 9–14 mm in diameter.
3. Petiole of larger leaves 20–60 mm long; lamina of larger leaves 10–23 cm wide, obovate; hairs on nut of samara white. *L. euryptera.*
3. Petiole of larger leaves 15–21 mm long; lamina of larger leaves 8–11 cm wide, obovate or elliptical; hairs on nut of samara stramineous to brown.
4. Lamina obovate, broadly rounded and deeply emarginate at apex, the abaxial vesture relatively loose; pseudoracemes 17–23 cm long, subvelutinous with the hairs dark brown; nut of samara 10–14 mm in diameter; bracts and bracteoles mostly deciduous in fruit. *L. surinamensis.*
4. Lamina elliptical, abruptly acuminate at apex, the abaxial vesture very tightly appressed; pseudoracemes 6–12.5 cm long, sericeous with the hairs golden or brown; nut of samara 9–10 mm in diameter; bracts and bracteoles persistent in fruit. *L. peruviana.*
2. Lateral wings of samara 15–38 mm long, 4–9 mm wide; dorsal wing of samara 5–13 mm wide, 5–18 mm high; nut of samara 3.3–8 mm in diameter.
5. Bracts in distal half of pseudoraceme 2.5–8 mm long; bracteoles 1.5–3 mm long, spreading; pseudoracemes containing 2–28 flowers; sepals 2–3 mm long beyond gland; inner face of seed locule glabrous. *L. inpana.*
5. Bracts in distal half of pseudoraceme 0.5–1 mm long; bracteoles 0.5–1.1 mm long, ascending or appressed; pseudoracemes containing (15–) 25–100 or more flowers; sepals 1–1.5 mm long beyond gland; inner face of seed locule strigose.
6. Peduncle 0.5–2.5 (–3) mm long; pedicel 2–4 mm long; hairs brown or dark brown throughout the inflorescence. *L. floribunda.*
6. Peduncle (2–) 2.5–4 mm long, with at least some peduncles in every inflorescence 2.5 mm long or longer; pedicel 3.3–5 (–6) mm long; hairs golden-brown or golden on ultimate axes of inflorescence, especially peduncles and pedicels. *L. occidentalis.*

Lophopterys euryptera Sandwith, Kew Bull. 1951: 34. 1951. *Lophopterys splendens* var. *obovata* Nied. in Engl., Pflanzenr. IV, 141: 385. 1928.—TYPE: GUYANA [BRITISH GUIANA]. Barama River, Oct fl, *Rich. Schomburgk 1536* (lectotype for both names, here designated: K!, the sheet with an inflorescence [WRA neg. 81-8-1]; isolectotype: K!). Fig. 3.

Woody liana to 35 m long; stem hairs stramineous or brownish fading to gray. Lamina of larger leaves 16–35 cm long, 10–23 cm wide, obovate, truncate or short-attenuate and often unequal at base, plane at margin, very broadly truncate to emarginate and often apiculate at apex, eglandular, initially loosely sericeous above but eventually glabrate with pubescence rarely persistent along midrib, densely and persistently sericeous below with very tightly appressed hairs giving the dried leaf a silvery to golden sheen, the 8–16 pairs of lateral veins prominent below, interconnected by prominulous parallel secondary veins, the intricate reticulum prominulous on both sides but hidden below by the vesture; petiole 20–60 mm long, persistently sericeous or glabrescent in age, eglandular or bearing 1–4 pairs of small glands at various distances from base along adaxial edges; stipules not found. Inflorescence tightly to loosely sericeous with the hairs brown to rarely white, 10–30 cm long, terminal and axillary, a panicle with the pseudoracemes 5–16 cm long and containing 10–50 flowers, the axis 1.5–3 mm in diameter; bracts and bracteoles abaxially sericeous to glabrate, persistent in fruit, triangular, appressed; bracts 2–3 mm long (proximal bracts up to 10 mm long), 1–2 (–3) mm wide; peduncle absent or up to 1 mm long in fruit; bracteoles 1.5–2.5 mm long, 1–1.5 mm wide; pedicel 3–8 mm long, 2–2.5 mm in diameter at apex, sericeous. Flowers erect or very slightly circinate in bud. Sepals triangular, 3–3.5 mm long (1–2 mm beyond gland), 2–3 mm wide, sometimes membranous at margin, acute to broadly obtuse at apex, abaxially sericeous, strongly appressed in anthesis; glands 1.5–2.5 mm long and 1.5–3 mm wide, transversely elliptical to circular, absent from one anterior-lateral sepal in some flowers. Petals glabrous; lateral petals with the claw 2.5–3.5 mm long, winged, the limb 5–6 mm long, 6–9 mm wide, concave, rotund or obovate, decurrent and weakly differentiated from the claw, erose and eglandular at margin; posterior petal with the claw 2.5–3 mm long, unwinged, not constricted at apex, the limb 3.5–4 mm long and wide, rectangular, flat and reflexed, fimbriate with the proximal fimbriae broadly glandular, the distal fimbriae finer and decreasingly glandular to eglandular. Filaments 2–3 mm long, connate in the proximal 0.5–1 mm; anthers 1.5–2 mm long, $\pm$ alike, reflexed, glabrous. Styles glabrous or sericeous in the proximal half, the anterior style 2–2.5 mm long, straight or very slightly reflexed at apex, the posterior two 2.5–3 mm long, strongly reflexed distally, all with the stigmas much wider than high (ca. 0.5–0.8 mm wide, 0.2–0.3 mm high), dorsally rounded, truncate, or slightly apiculate at apex. Samara with the nut spheroidal, ca. 9–11 mm in diameter, smooth on sides or bearing obscure vertical ribs and smooth between wings, sericeous, the hairs white and persistent; lateral wings 45–62 mm long, 10–18 mm wide, narrowly elliptical and gradually tapered distally to a rounded or obtuse apex, sericeous to glabrate; dorsal wing encircling much of the nut, trapezoidal-flabellate, 10–19 mm wide, 19–25 mm high, entire or slightly erose, sericeous; ventral areole 4–6 mm high and wide, ovate; inner face of seed locule appressed-tomentose.

Phenology. Probably flowering and fruiting in all months

Distribution (Fig. 1). Central to northern Guyana and eastern Venezuela; lowland rainforests; 75–320 m.

ADDITIONAL SPECIMENS EXAMINED. **Guyana.** Mahdia Creek, Potaro River, 107 miles on Bartica–Potaro road, Jan fr, *Fanshawe in Forest Dept.* 3749 (K); Barima River, Mar fl, *Jenman* 6994 (K, NY); Barima-Waini Region, trail between Aranka Head and Barima Head, NW of Kariako River, 07°30'N, 60°35'W, 76–122 m, mixed forest, slopes and terraces, Apr fl, *McDowell* 4386 (MICH); upstream from Kariako Village, Barama River, North-West District, 07°22'N, 59°42'W, 145 m, riparian forest, Jan ster, *van Andel & Samuels* 906 (MICH). **Venezuela.** BOLÍVAR: Alto Río Cuyuní, Río Uiri-yuk,

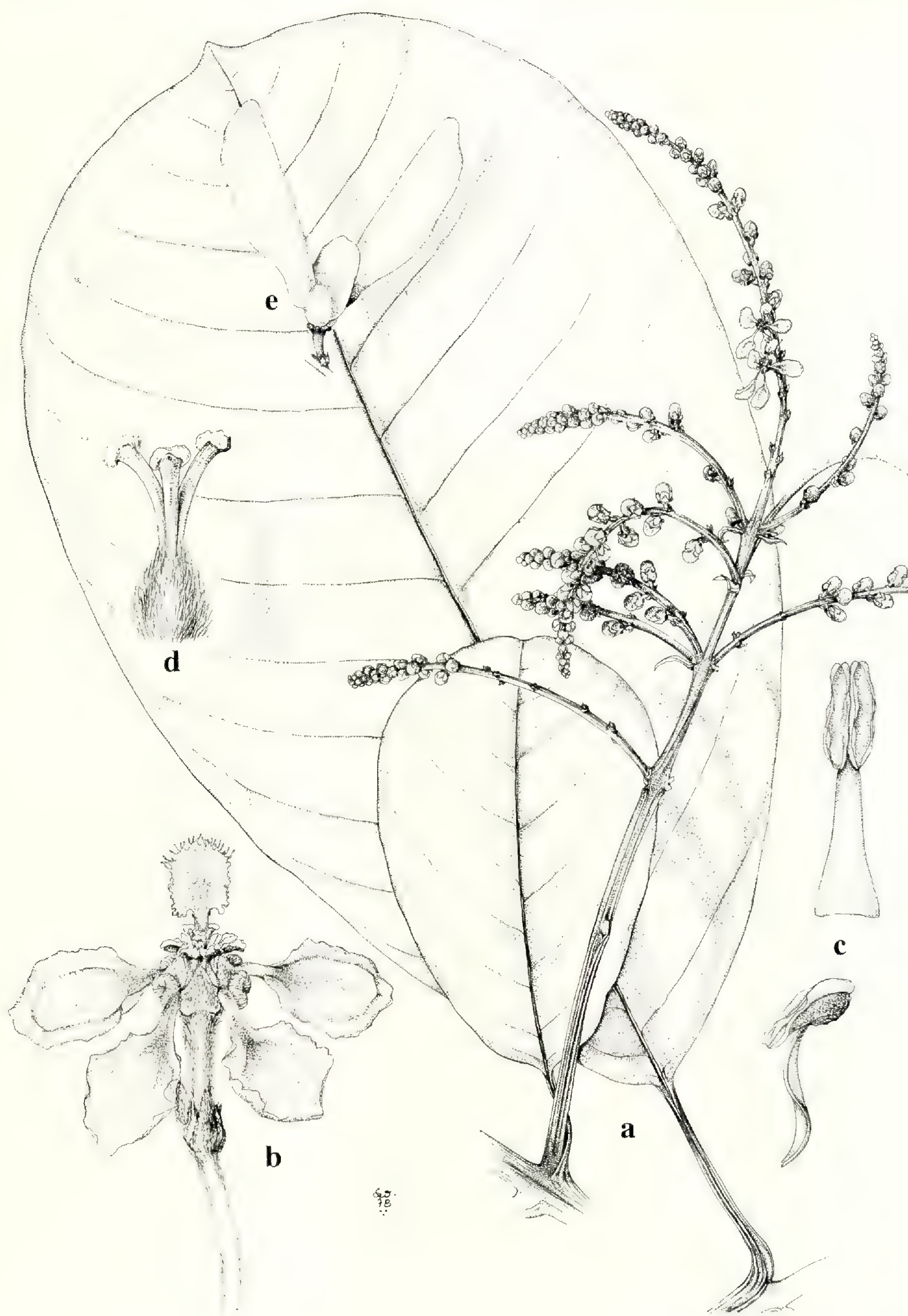


FIG. 3. *Lophopterys euryptera*. a. Leaf and inflorescence, $\times 0.5$. b. Flower, $\times 2.5$. c. Stamens, $\times 10$. d. Gynoecium, anterior style in center, $\times 7.5$. e. Samara, $\times 0.5$. (Based on: a–d, Breteler 3752; e, Maguire et al. 46977.)

along river, Aug fr, *Maguire et al.* 46977 (K, MICH, MY, NY, US, VEN).—DELTA AMACURO: E of Río Grande, ENE of El Palmar, near Bolívar border, Jun/Jul fl/fr, *Blanco* 155 (VEN); near Bolívar border, 08°04'N, 61°44'W, low primary forest, 320 m, Apr fl, *Breteler* 3752 (MER, MO, NY, U, US, VEN); E of Río Grande, directly E of El Palmar, swampy mature forest, Jul fr, *Gentry & Berry* 14942 (MICH, MO); between La Margarita and Puerto Miranda, Río Acure, rainforest, 80–100 m, Nov fr, *Steyermark* 87776 (NY, VEN); E of Río Grande, 37 km ENE of El Palmar, rainforest, 320 m, Feb fr, *Steyermark* 93148 (NY, U, VEN).

This species is generally most like its nearest neighbor, *L. surinamensis* (see Fig. 1). Both have large samaras and sessile or subsessile pedicels, but *L. euryptera* is distinguished by its larger leaves and especially by its petioles, the longest in the genus.

Lophopterys floribunda W. R. Anderson & C. C. Davis, sp. nov.—TYPE: BRAZIL. Minas Gerais: Manhuaçu, arredores, orla da mata, 15 Oct 1983 fl, *G. Hatschbach & O. Guimarães* 46868 (holotype: MBM!; isotype: MICH!).

Liana lignosa vel frutex usque ad 1 m altus; lamina foliorum majorum 11–23 (–26) cm longa, 5–11 (–13) cm lata, apice ± abrupte breviacuminata vel rotundata vel obtusa breviapiculataque, petiolo 10–25 mm longo; pseudoracemi ex (25–) 40–100 plusve floribus constantes; bracteae 0.5–1.5 mm longae; pedunculi pedicellique brunnei vel atrobrunnei, illi 0.5–2.5 (–3) mm longi, hi 2–4 mm longi; bracteolae 0.5–1.1 mm longae, ± appressae; sepala glandulas 1–1.5 mm superantia; antherae pilosae; nux samarae 4–6 mm diametro, alae laterales 25–35 mm longae, 6–9 mm latae, ala dorsalis 6–11 mm lata, 10–18 mm alta, locus intus strigosus.

Woody liana or shrub 1 m tall; stem hairs ferruginous fading to gray. Leaves opposite or subopposite; lamina of larger leaves 11–23 (–26) cm long, 5–11 (–13) cm wide, narrowly to broadly elliptical, cuneate, obtuse, or rounded at base, nearly or quite plane at margin, ± abruptly short-acuminate at apex to rounded or obtuse and short-apiculate, eglandular, sericeous above to usually glabrate in age or persistently sericeous on midrib, especially proximally (occasionally ± persistently sericeous all over adaxial surface), densely and persistently sericeous below, the hairs very short and tightly appressed, all the same color or slightly darker on midrib and lateral veins, giving the dried leaf a silvery, golden, or bronze metallic sheen, the 8–13 pairs of lateral veins prominent below, the intricate reticulum usually prominulous on both sides; petiole 10–25 mm long, persistently sericeous, eglandular or bearing 1–7 pairs of small glands embedded in adaxial edges; stipules not found. Inflorescence tightly brown- or dark-brown-sericeous, 13–30 cm long, terminal and axillary, paniculate, the pseudoracemes 5–21 cm long and containing (25–) 40–100 or more flowers, the axis 0.8–1.5 mm in diameter; bracts and bracteoles abaxially thinly to densely sericeous, persistent, triangular, ascending or appressed; bracts 0.5–1.5 mm long and wide; peduncle 0.5–2.5 (–3) mm long; bracteoles 0.5–1.1 mm long and wide; pedicel 2–4 mm long, 0.9–1.5 mm in diameter at apex. Flowers slightly circinate to erect in bud. Sepals ovate or triangular, 1.5–2 mm long (1–1.5 mm beyond gland), 1.2–2 mm wide, often membranous and slightly revolute at margin, broadly obtuse or rounded at apex, abaxially brown- or golden-brown-sericeous, appressed in anthesis; glands 1–1.8 mm long, 1.5–2.3 mm wide, occasionally circular but mostly transversely elliptical. Lateral petals glabrous or very sparsely sericeous abaxially in the center, the claw 0.5–1 mm long, winged, the limb 5.5–8.5 mm long, 5.5–9 mm wide, somewhat concave to flat, obovate, erose or dentate and eglandular at margin; posterior petal glabrous, the claw very thick, 2.5–3 mm long, unwinged, usually ± constricted at apex, the limb

2.5–3 mm long and wide, orbicular or rectangular, $\pm$ crumpled, erect to reflexed, dentate or short-fimbriate with the divisions all eglandular or the proximal ones slightly glandular-thickened. Filaments 1.5–3 mm long, 1/3–2/3-connate; anthers 0.9–1.2 mm long, $\pm$ similar, erect or reflexed, the locules loosely pilose. Styles sericeous at base, 1.2–2 mm long, divergent to strongly spreading, dorsally rounded at apex, terete or laterally flattened, the stigmas orbicular or vertically to horizontally elliptical. Samara with the nut spheroidal, 4–6 mm in diameter, smooth on sides or bearing many obscure to prominent vertical ribs and smooth to irregularly rugulose between lateral and dorsal wings, sericeous or subvelutinous, the hairs brown; lateral wings 25–35 mm long, 6–9 mm wide, narrowly elliptical and obtuse or rounded (rarely acute) at apex, sericeous; dorsal wing encircling much of the nut, trapezoidal, 6–11 mm wide, 10–18 mm high, entire or erose, sericeous; ventral areole 2.5–3.5 mm high and wide, ovate; inner face of seed locule strigose.

Phenology. Collected with flowers from July to December, most commonly in September, and with fruits from September to December.

Distribution (Fig. 1). Central to eastern Amazonian Brazil and southeastern Brazil where Bahia, Espírito Santo, and Minas Gerais come together; edge of wet forest on terra firme, at low elevations, up to 620 m.

ADDITIONAL SPECIMENS EXAMINED. **Brazil.** AMAPÁ: Mpio. Calçoene, 53–72 km WNW of Calçoene, 02°33'–38'N, 51°16'W, Dec fl/imm fr, *Rabelo et al.* 2966 (MG, MICH, ULM).—AMAPÁ/PARÁ: Rio Jarí, Monte Dourado, Planalto B, entre Pilão e Repartimento, Oct fl, *N. T. Silva* 1324 (MICH, NY).—AMAZONAS: Estrada Manaus–Caracará, Km 57, Sep bud, *Damião* 699 (INPA).—BAHIA: 5 km W of Itamaraju, Sep bud, *Mori et al.* 10746 (CEPEC, MICH).—ESPÍRITO SANTO: Santa Teresa, estrada de Tabocas para Várzea Alegre, 550 m, Nov fl/fr, *Kollmann* 926 (MICH).—MINAS GERAIS: Mpio. Marliéria, Parque Estadual do Rio Doce, 19°46'S, 42°36'W, 450 m, Sep fl, *Heringer & Eiten* 15099 (MICH, MO); Parque Estadual do Rio Doce, Marliéria, início da trilha do Vinhático, 19°45'95"S, 42°37'38"W, Sep fl, *Lombardi* 1981 (MICH); Estação Biológica da Caratinga, fazenda Montes Claros, Caratinga, 19°43'53"S, 41°49'02"W, Sep fl, *Lombardi* 2357 (MICH); Jequeri, Nov fr, *Salino* 3805 (MICH).—PARÁ: Near Breu Branco, ca. 30 km N of Tucuruí, Feb ster, *Anderson* 13754 (MICH); Parauapebas, Reserva Biológica da Serra dos Carajás, 620 m, Jan ster, *dos Santos et al.* 419 (MICH); Tucuruí, PA-149, Oct fl, *Lima & A. Silva* 04 (INPA, NY); Marabá, Carajás, Serra Norte, PA-275, Aug fl, *Maciel et al.* 729 (NY); Tucuruí, PA-149, Oct fl, *Miranda et al.* 682 (INPA, NY); Rio Itacaiunas, afl. do R. Tocantins, Serra Buritirama, Marabá, 05°30'S, 50°15'W, Jul bud, *Murça Pires & Belém* 12586 (IAN, MICH); Tucuruí, Rio Tocantins, foz do Rio Pitinga, Sep fl/fr, *Ramos & Lima* 1544 (INPA); Serra dos Carajás, 13 km from AMZA headquarters, road to sawmill, Oct fl/fr, *A. S. Silva* 71 (MICH, MG); Serra dos Carajás, Aug fl, *N. T. Silva & Ribeiro* 3587 (MICH).

This species comprises, with *L. occidentalis*, a widespread and variable complex defined by the many-flowered pseudoracemes (hence the epithet *floribunda*), pilose anthers, and small samaras. The populations of that complex fall into three geographic ranges, including a group in southwestern Amazonia (described below as *L. occidentalis*), a group in central and eastern Amazonia, and a group in southeastern Brazil where Minas Gerais, Espírito Santo, and Bahia come together (Fig. 1). The latter two groups are treated here as the single species *L. floribunda*, in spite of the fact that the southern populations tend to have shorter pseudoracemes with darker vesture than the more northern populations. We are unable at this time to find stable differences that would allow us to distinguish the northern and southern populations in a defensible way. We offer this two-species resolution of the complex with some diffidence—it may well be that future workers will prefer to treat the whole complex as one variable species, or they may find bases for formal taxonomic recognition of all three geographical entities.

Lophopterys inpana W. R. Anderson, Contr. Univ. Michigan Herb. 17: 46. 1990.—

TYPE: BRAZIL. Rondônia: Summit of Serra dos Pacaás-Novos, 12 km NNE of Guajará-Mirim, 400 m, Aug fl, *G. T. Prance et al.* 6675 (holotype: INPA!; isotypes: MG! MICH! MO! NY! US!). Figs. 2b, 4.

Woody liana or shrub up to 4 m tall; stem hairs initially reddish brown but sometimes fading to gray. Lamina of larger leaves 8.9–19.8 cm long, 3.4–10 cm wide, ovate or elliptical, cuneate or rounded at base, plane or slightly revolute at margin, sometimes short-acuminate but mostly acute or obtuse to rounded and often apiculate at apex, eglandular or occasionally bearing 2 small glands on margin at base, initially sericeous above but soon or eventually glabrate with pubescence occasionally persistent along midrib and margins and rarely on lamina, densely and persistently sericeous below with very tightly appressed hairs giving the dried leaf a bronze to golden metallic sheen, the 7–9 (–12) pairs of lateral veins prominent below, the intricate reticulum prominulous on both sides but hidden below by the vesture; petiole 10–18 (–22) mm long, persistently sericeous, eglandular or bearing 1–3 pairs of small glands at middle or at various distances above or below middle along adaxial edges; stipules absent or vestigial, ca. 0.2 mm long, borne on adaxial edges of petiole 1–2 mm above base. Inflorescence sericeous with the hairs reddish brown, (4.5–) 6–24 cm long, terminal and axillary, racemose or paniculate, the pseudoracemes 2–12 (–13.8) cm long and containing 2–28 mostly decussate flowers, the axis 0.7–1.5 mm in diameter; bracts and bracteoles abaxially sericeous, adaxially thinly sericeous or glabrous, mostly persistent in fruit, spreading, often bearing 2 tiny glandular spots at abaxial base (especially bracts); bracts 2.5–8 mm long (proximal bracts up to 16.3 mm long), 1–2 mm wide, narrowly triangular; peduncle 1.7–9 mm long; bracteoles 1.5–3 mm long, 1–2.3 mm wide, with the reticulum often visible on adaxial surface, mostly ovate or elliptical to rotund; pedicel 3.5–14 mm long, 0.7–1.4 mm in diameter at apex, sericeous. Flowers slightly circinate in bud. Sepals elliptical, 3–4 mm long (2–3 mm beyond gland), 1.6–2.5 mm wide, often membranous and slightly revolute at margin, broadly rounded at apex, abaxially sericeous, appressed in anthesis, often becoming somewhat spreading and more revolute at margin in fruit; glands 1.4–2.4 mm long and 1.8–3.4 mm wide, circular or more often transversely elliptical and sometimes emarginate at apex or at apex and base, rarely absent from all sepals. Petals usually glabrous, rarely sparsely sericeous abaxially on limb; lateral petals with the claw 1.5–3.6 (–4.4) mm long, winged, the limb 6–11 mm long, (6.2–) 7–12 mm wide, somewhat concave to flat, rotund or obovate, erose or dentate to short-fimbriate and eglandular at margin; posterior petal with the claw 3–4.2 mm long, unwinged, not constricted at apex, the limb (4.2–) 5.4–7 mm long, 4.3–7.5 mm wide, obovate, flat, erect to reflexed, fimbriate to lacerate with the proximal divisions sometimes fleshy or glandular. Filaments 2.2–3 mm long, basally connate; anthers 1–1.5 (–2.2) mm long, alike, erect or reflexed, glabrous. Styles sericeous on proximal half, 2–3 mm long, erect to divergent, dorsally rounded at apex, the stigmas obovate and decurrent. Samara with the nut spheroidal, 3.5–4.5 (–6) mm in diameter, smooth on sides and between wings, sericeous, the hairs golden to whitish and persistent or unevenly deciduous; lateral wings 15–23 (–26) mm long, 4–7 mm wide, narrowly elliptical or slightly obovate with the margins parallel to divergent distally, more or less abruptly narrowed to the rounded or obtuse apex, sericeous to glabrate; dorsal wing 1/2–2/3-encircling the nut, trapezoidal, 5–12 (–13) mm wide, (5–) 7–9 mm high, the upper margin irregularly



FIG. 4. *Lophopterys inpana*. a. Flowering branch, $\times 0.5$. b. Distal portion of petiole enlarged to show glands, $\times 5$. c. Unit of the inflorescence enlarged to show spreading bracts and bracteoles, $\times 2$. d. Flower, with posterior petal uppermost, $\times 2$. e. Stamens, abaxial view (left) and adaxial view (right), $\times 10$. f. Gynoecium, $\times 10$. g. Immature samara, $\times 1.5$. (Based on: a–c, *Prance 6675*; d–g, *Killeen 2750*.)

sinuous, sericeous to glabrate; ventral areole 2–2.5 mm in diameter, broadly ovate or rotund; inner face of seed locule glabrous.

Phenology. Collected with flowers in January, June, and especially August, September, and October, and with fruits in September, October, and November.

Distribution (Fig. 1). Central Amazonian Brazil to western Amazonia, from southern Venezuela to Peru, Bolivia, and Rondônia, Brazil; occasionally in wet forest, but mostly in more open places, such as low forest, thickets, or savannas; 50–800 m.

ADDITIONAL SPECIMENS EXAMINED. **Bolivia.** BENI: Between Guayaramerín and Cachuela Esperanza, savanna and low, seasonally flooded woods, Sep fl, *Michel & Capra 2346, 2370* (MICH).—SANTA CRUZ: Velasco Province, Parque Nacional Noel Kempf, $13^{\circ}36'–14^{\circ}40'S$, $60^{\circ}40'–54'W$, low dry forest, rocky campo, open savanna, edge of pampa and forest, Nov fr, *Foster 14006* (F, MICH), Aug fl,

Guillén et al. 4159 (MICH), Oct fl/imm fr, *Killeen* 2750 (F, MICH, NY), Oct fr, *Killeen* 5851 (MICH), Aug fl, *Toledo* 37 (F), Sep fr, *Vargas* 3950 (MICH), Oct fl/fr, *Vargas* 3998 (CTES, MO), 4053 (F, MO). **Brazil.** AMAZONAS: Distr. Agropecuário, Reserva 1501 (Km 41) da WWF/INPA Projeto da Dinâmica Biológica dos Fragmentos Florestais, 02°25'31"–26'S, 59°43'40"–45'50"W, terra firme, Aug fl, *Lepsch da Cunha et al.* 296 (MICH, MO, NY); Km 65–70, Manaus–Itacoatiara, Oct fl, *Oliveira* 2752 (UB); Reserva Florestal Ducke, Manaus–Itacoatiara Km 26, 02°53'S, 59°58'W, Sep fl, *Sothers* 162 (MICH); Humaitá, Estrada Humaitá–Jacareacanga, Km 64–70, 07°45'S, 62°32'W, roadside thicket, Jun fl, *Teixeira et al.* 1124 (INPA, K, MG, MICH, MO). **Peru.** HUÁNUCO: Pachitea Province, region of Pucallpa, W part of the Sira Mountains and adjacent lowland, 20–24 km SE of Puerto Inca, 09°28'S, 74°47'W, primary mountain rain forest, *Morawetz & Wallnöfer* 11-27888 (Aug fl), 11-41088 (Oct fr), 13-10988 (Sep fl), 13-28888 (Aug fl) (all MICH). **Venezuela.** AMAZONAS: Depto. Atabapo, ca. 15 km SE of San Fernando de Atabapo, 03°55'N, 67°40'W, bosque muy húmedo de tierra firme, Jan fl/imm fr, *Stergios et al.* 11604 (MICH, MO).

The small fruits of this species immediately distinguish it from most species of *Lophopterys*. The only other species with such small samaras are *L. floribunda* and *L. occidentalis*, both of which have hairy anthers. *Lophopterys inpana* is also notable for its relatively long, spreading bracts and bracteoles.

Lophopterys occidentalis W. R. Anderson & C. C. Davis, sp. nov.—TYPE: BRAZIL.

Acre: 12 km from Rio Branco on Rio Branco–Pôrto Velho road, disturbed primary forest, Sep fl/imm fr, *S. R. Lowrie et al.* 293 (holotype: INPA!; isotypes: INPA! MG! MICH! NY!). Figs. 2a, 5.

Liana lignosa vel frutex usque ad 1 m altus; lamina foliorum majorum 11–18.5 cm longa, 5.5–8 cm lata, apice ± abrupte breviacuminata vel rotundata vel obtusa breviapiculataque, petiolo 10–19 mm longo; pseudoracemi ex (15–) 25–80 floribus constantes; bracteae 0.8–1.1 mm longae; pedunculi pedicellique aurei vel aureo-brunnei, illi (2–) 2.5–4 mm longi, hi 3.3–5 (–6) mm longi; bracteolae 0.6–1 mm longae, ± appressae; sepala glandulas 1–1.5 mm superantia; antherae pilosae; nux samarae 3.5–4.5 mm diametro, alae laterales 21–30 mm longae, 7–9 mm latae, ala dorsalis 6–10 mm lata, 7–13 mm alta, locus intus strigosus.

Woody liana or shrub 1 m tall; stem hairs ferruginous fading to gray. Leaves opposite or subopposite; lamina of larger leaves 11–18.5 cm long, 5.5–8 cm wide, elliptical or slightly ovate, cuneate, obtuse, or rounded at base, nearly or quite plane at margin, ± abruptly short-acuminate at apex to rounded or obtuse and short-apiculate, eglandular, sericeous above to glabrate in age or persistently sericeous on midrib, especially proximally, densely and persistently sericeous below, all the hairs very short and tightly appressed, brown on and near midrib and lateral veins and lighter in other areas, giving the dried leaf a light bronze metallic sheen, the (6–) 8–13 pairs of lateral veins prominent below, the intricate reticulum ± prominent above, prominulous below; petiole 10–19 mm long, persistently sericeous, eglandular or bearing 1–5 pairs of small glands embedded in adaxial edges; stipules not found. Inflorescence tightly brown-sericeous on main axes, more loosely sericeous to subvelutinous on ultimate branches, peduncles, and pedicels with the hairs golden-brown or golden, 12–21 cm long, terminal and axillary, paniculate, the pseudoracemes (3–) 5–16 cm long and containing (15–) 25–80 flowers, the axis 0.8–1 mm in diameter; bracts and bracteoles abaxially sericeous, persistent or irregularly deciduous in fruit, narrowly triangular, ascending or appressed; bracts 0.8–1.1 mm long, 0.5–0.8 mm wide; peduncle (2–) 2.5–4 mm long (at least some in every inflorescence 2.5 mm long or longer); bracteoles 0.6–1 mm long, 0.4–0.8 mm



FIG. 5. *Lophopterys occidentalis*. a. Flowering and fruiting branch, $\times 0.5$. b. Flower bud and adjacent portion of inflorescence, $\times 4$. c. Flower, side view, $\times 3$, and posterior petal, adaxial view, $\times 5$. d. Anthers, abaxial view (left) and adaxial view (right), $\times 15$. e. Gynoecium, anterior style to left, $\times 10$. f. Style tip, adaxial view, $\times 15$. g. Samaras, side view (left) and abaxial view (right), both $\times 1$. (Based on Lowrie *et al.* 293.)

wide; pedicel 3.3–5 (–6) mm long, 0.7–1.2 mm in diameter at apex. Flowers slightly circinate to erect in bud. Sepals ovate or elliptical, 1.3–2 mm long (1–1.5 mm beyond gland), 1.4–1.7 mm wide, often membranous and slightly revolute at margin, broadly obtuse or rounded at apex, abaxially golden-sericeous, appressed in anthesis, often becoming somewhat spreading and more revolute at margin in fruit; glands 1–1.5 mm long, 1.5–2 mm wide, transversely elliptical. Petals glabrous; lateral petals with the claw 0.5–1.3 mm long, winged, the limb 4–6.5 mm long, 4–6 mm wide, somewhat concave to flat, obovate, sinuate or erose to dentate and eglandular at margin; posterior petal with the claw very thick, 2.5–3.5 mm long, unwinged, $\pm$ constricted at apex, the limb 2–2.7 mm long, 1.3–2.9 mm wide, orbicular or rectangular, $\pm$ crumpled, erect to reflexed, fimbriate proximally with the divisions sometimes fleshy or glandular. Filaments 1.5–2.5 mm long, 1/3–1/2-connate; anthers (0.6–) 0.8–1.2 mm long, subsimilar, erect or reflexed, the locules loosely pilose. Styles sericeous on proximal half, 1.5–2 mm long, divergent, dorsally rounded at apex, laterally $\pm$ flattened, the stigmas orbicular to vertically elliptical. Samara with the nut spheroidal or short-cylindroidal, 3.5–4.5 mm in diameter, with many vertical ribs on sides and irregularly rugulose between lateral and dorsal wings, sericeous or subvelutinous, the hairs stramineous; lateral wings 21–30 mm long, 7–9 mm wide, narrowly elliptical or obovate and obtuse or rounded at apex, sericeous; dorsal wing encircling much of the nut, trapezoidal, 6–10 mm wide, 7–13 mm high, entire, sericeous; ventral areole 2.5–3 mm high and wide, ovate; inner face of seed locule strigose.

Phenology. Collected with flowers in September, and with fruits in late September, October, and November.

Distribution (Fig. 1). Southwestern Amazonian Brazil and adjacent Bolivia; wet primary or secondary forest on terra firme, at elevations up to 200 m.

ADDITIONAL SPECIMENS EXAMINED. **Bolivia.** BENI: Vicinity of the Chácobo village Alto Ivon, 11°45'S, 66°02'W, Nov fr, *Boom* 4035 (MICH, NY).—PANDO: Prov. Madre de Dios, camino de Sena hacia el Río Beni, Oct fr, *Beck et al.* 20377 (MICH). **Brazil.** AMAZONAS: Track from Bôca do Acre airstrip to Monte Verde, north bank of Rio Purus, Sep fl, *Prance et al.* 2468 (INPA, MG, MICH, NY).—RONDÔNIA: Km 8–23, Pôrto Velho, Sep fl, *Maguire et al.* 56702 (MICH, NY).

Our epithet for this species refers to its distribution, well to the west of the other populations in the *Lophopterys floribunda/occidentalis* complex. See discussion under *L. floribunda*.

Lophopterys peruviana W. R. Anderson, Contr. Univ. Michigan Herb. 19: 376. 1993.—TYPE: PERU. Amazonas: Alrededor de yucui entsa 6 horas de pongo del camino de Kusu, monte, 360–600 m, 12 Mar 1973 fr, *R. Kayap* 569 (holotype: MICH!; isotypes: F! MO!). Fig. 6.

Woody liana climbing to 25 m; stem hairs initially golden-brown but usually fading to gray. Lamina of larger leaves 15–22.5 cm long, 8.5–11 cm wide, elliptical, rounded or cuneate at base, plane at margin, abruptly acuminate at apex, eglandular or occasionally biglandular on margin at base, initially sericeous above to very soon glabrate with pubescence often persistent along midrib and occasionally on lamina, densely and persistently sericeous below with very short and tightly appressed hairs giving the dried leaf a gray or silvery aspect, the 7–9 pairs of lateral veins prominent below, interconnected by prominulous parallel secondary

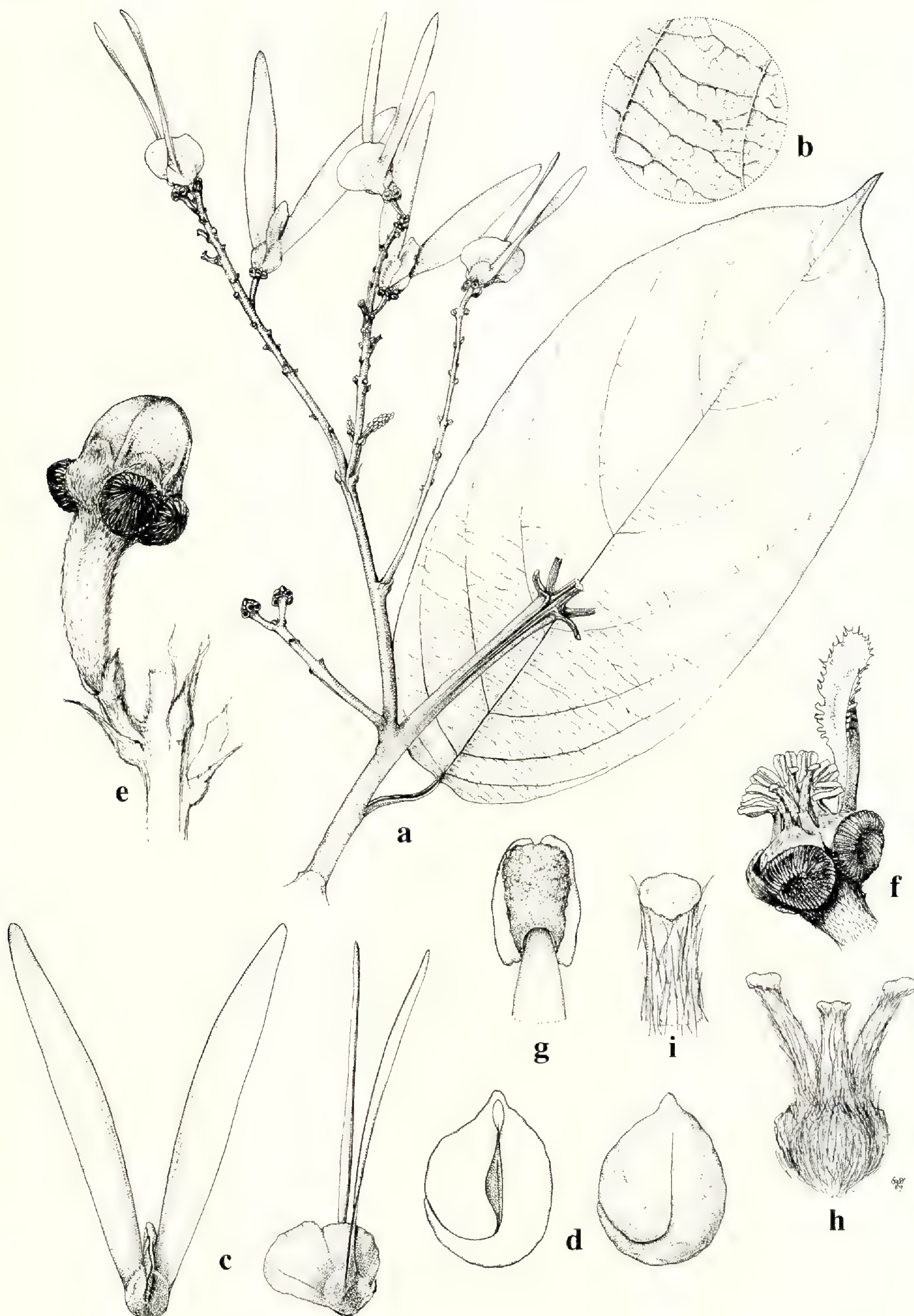


FIG. 6. *Lophopterys peruviana*. a. Fruiting branch, $\times 0.5$. b. Enlargement of adaxial surface of lamina to show scalariform crossveins, $\times 2.5$. c. Samaras, abaxial view (left) and side view (right), $\times 0.75$. d. Embryos, whole (right) and in longitudinal section (left), $\times 3$. e. Flower bud, $\times 5$. f. Flower, side view, with erect posterior petal, $\times 4$. g. Anther, abaxial view, $\times 15$. h. Gynoecium, anterior style in center, $\times 10$. i. Style tip, adaxial view, $\times 15$. (Based on: a–d, *Kayap* 569; e–i, *Klug* 654.)

veins, the intricate reticulum prominulous on both sides; petiole 16–21 mm long, persistently sericeous, eglandular or usually bearing a pair of large glands on adaxial edges near apex and sometimes a second more proximal pair as well, or bearing 1–4 pairs of small glands on the distal half; stipules absent or vestigial, 0.2–0.5 mm long, borne on adaxial edges of petiole 1–2 mm above base. Inflorescence densely and persistently sericeous with the hairs golden or brown, 11–20 cm long, paniculate, the pseudoracemes 6–12.5 cm long and containing 15–60 flowers, the axis 1.4–2 mm in diameter; bracts and bracteoles abaxially sericeous to glabrate, persistent in fruit, appressed or spreading distally; bracts 1.5–3 mm long, 0.8–1.5 mm wide, narrowly triangular or triangular; peduncle 1–2 mm long; bracteoles like bracts but only 0.8–1 mm long, 0.5–1 mm wide, triangular or ovate; pedicel 4–7 mm long, 1.5 mm in diameter at apex, sericeous. Flowers slightly circinate to erect in bud. Sepals ovate, ca. 1 mm long beyond gland, 1.5–2 mm wide, broadly obtuse to rounded, abaxially densely sericeous to glabrescent, appressed in anthesis; glands 2–3.5 mm in diameter, circular. Petals glabrous; open flowers with intact lateral petals not seen; posterior petal ca. 6 mm long, obovate, the limb long-decurrent on the claw, toothed with the proximal teeth glandular. Filaments 1.5–2 mm long, up to 1/3-connate; anthers 1.3–1.5 mm long, alike, erect to reflexed, glabrous. Styles sericeous their entire length, ca. 1.5 mm long, erect to divergent distally, dorsally rounded at apex, the stigmas transversely elliptical, much wider than high, and slightly decurrent. Samara with the nut spheroidal, 9–10 mm in diameter, smooth or slightly rugulose with the texture hidden by hairs, sericeous or appressed-tomentose, the hairs brown; lateral wings 45–50 mm long, 10–15 mm wide, narrowly elliptical and gradually tapered distally to an obtuse or rounded apex, sericeous; dorsal wing encircling much of the nut, trapezoidal, 10–20 mm wide, 20–30 mm high, entire or slightly sinuous, sericeous; ventral areole 5–6 mm high, 4 mm wide, ovate to nearly rotund; inner face of seed locule very sparsely sericeous.

Phenology. Collected with flowers in December, and with fruits in December and March.

Distribution (Fig. 1). Endemic to Peru; forest; 100–600 m.

ADDITIONAL SPECIMENS EXAMINED. **Peru.** LORETO, Maynas Province: Mishuyacu near Iquitos, forest, Dec fl, *Klug 654* (F, NY, US); Km 44, carretera Iquitos–Nauta, bosque primario, Dec fr, *Vásquez & Jaramillo 11420* (MICH).

The single flowering collection (*Klug 654*) differs in several respects from the two fruiting collections. Its bracts are narrow and gradually tapered, the inflorescence hairs are golden, and the petiole bears only very small glands, like those seen in other species of the genus. The fruiting collections have shorter, ovate, obtuse bracts and bracteoles, brown inflorescence hairs, and one or two pairs of large glands near the apex of the petiole. Those three collections may represent two different species, but we hesitate to try to distinguish them now because we do not have material in comparable stages of development. We are also influenced by the fact that *Klug 654* and one of the fruiting collections, *Vásquez & Jaramillo 11420*, came from the same area. When more and better collections become available it may be possible to refine the taxonomy proposed here.

When describing this species, one of us (WRA) stated that the anthers are sparsely sericeous between the locules. After re-examining the same specimens we cannot confirm the presence of those hairs.

Lophopterys splendens Adr. Juss. in Deless., Icon. Sel. Pl. 3: 18, pl. 29. 1838.
Lophopterys splendens var. *oblanceolata* Nied. in Engl., Pflanzenr. IV, 141: 385. 1928, *nom. superfl.*—TYPE: FRENCH GUIANA. Without locality, fr, *Poiteau s.n.* (holotype: G!; isotypes: B† [F neg. 12750], G! K! [WRA negs. 91-1-20, 21], P-JU 11542! [WRA neg. 81-15-18]). Fig. 7.

Woody liana or small tree 6 m tall; stem hairs golden or stramineous fading to gray. Lamina of larger leaves 16–ca. 27 cm long, 5.2–12.6 cm wide, elliptical to obovate, cuneate at base, nearly plane at margin, abruptly acuminate at apex, eglandular, glabrate above at maturity or persistently sericeous on midrib, especially proximally, densely and persistently sericeous below with an underlayer of very short, tightly appressed hairs and an overlayer of fewer, much longer, somewhat looser hairs, the aggregate giving the dried leaf a golden or bronze sheen, the 9–13 pairs of lateral veins prominent below, the intricate reticulum prominent on both sides; petiole (11–) 12–22 mm long, persistently sericeous, eglandular or bearing 1–5 pairs of small glands in the middle third on adaxial edges; stipules not found. Inflorescence loosely sericeous to subvelutinous with the hairs brown or stramineous to gray, 15–45 cm long, terminal and axillary, racemose or paniculate, the pseudoracemes 5–26 cm long and containing 8–70 flowers, the axis 2–3.5 mm in diameter; bracts and bracteoles abaxially loosely sericeous, persistent or irregularly deciduous in fruit, narrowly triangular, appressed; bracts 2.7–5 mm long, 1–1.9 mm wide; peduncle absent or up to 1 mm long in fruit; bracteoles 1.4–2.2 mm long, 0.6–1 mm wide; pedicel 8–12 mm long, 2–2.8 mm in diameter at apex, loosely sericeous to subvelutinous. Flowers erect in bud. Sepals triangular, 3.5–4.5 mm long (1.5–2.1 mm beyond gland), 2.5–3.5 mm wide, plane at margin, acute at apex, abaxially densely sericeous, strongly appressed in anthesis; glands 2.3–3.5 mm in diameter, obovate to rotund. Petals glabrous; lateral petals with the claw 3.7–4.3 mm long, obtriangular and 2.2–2.5 mm wide at apex, the limb 7–7.5 mm long, 8–10 mm wide, deeply concave, oblate to rotund, erose and eglandular at margin; posterior petal with the claw 3.5 mm long, stout (0.8 mm in diameter), not constricted at apex, the limb 5.5 mm long and 4.2 mm wide, rectangular, reflexed in the distal half, glandular-fimbriate with the proximal fimbriae longest. Filaments 2–2.5 mm long, connate in the proximal 1/3; anthers 1.8–2 mm long, alike, reflexed, glabrous. Styles basally sericeous, 2.5–3 mm long, erect proximally and divergent in the distal half (but becoming strongly divergent with age), all with the stigmas much wider than high (ca. 0.6 mm wide, 0.3 mm high), dorsally obtusely apiculate at apex. Mericarp with the nut roughly ellipsoidal, 15–20 mm long, 10–13 mm wide, with several prominent parallel longitudinal veins on each side converging in a subhorizontal ridge near apex where the lateral wing would develop in other species, sericeous or appressed-tomentose, the hairs brown, persistent; lateral wings absent; dorsal wing encircling distal 1/2–2/3 of the nut, a crest arising abruptly at style and extending over the apex and about 1/2–2/3 down the dorsal edge, ca. 4–5 mm wide, widest near apex of nut, 15–17 mm high, somewhat revolute, sericeous; ventral areole 4.5 mm high, 3.5 mm wide, ovate.

Phenology. Flowering in January.

Distribution (Fig. 1). Known only from low-elevation forests in eastern French Guiana, near the coast; to be expected in Amapá, Brazil.

ADDITIONAL SPECIMENS EXAMINED. **French Guiana.** Layon Montagne Prise d'Eau, bassin de l'Approuague, 04°28'N, 52°02'W, forêt de pente de basse altitude, Jul ster, *Hequet* 388 (U); without



FIG. 7. *Lophopterys splendens*. a. Flowering branch, $\times 0.5$. b. Enlargement of adaxial surface of lamina to show reticulum, $\times \text{ca. } 2.5$. c. Flower bud, $\times 2.5$. d. Flower, side view, and posterior petal, flattened, adaxial view, both $\times 2$. e. Anthers, adaxial view (left) and abaxial view (right), $\times 5$. f. Gynoecium, anterior style in center, $\times 5$, and adaxial view of tip of anterior style, $\times 10$. g. Fruit with only two mericarps developed, $\times 1$. (Based on: a–f, Oldeman B.2666; g, photograph and drawing of type.)

locality, fl, *Martin s.n.* (BM); Crique Simon, basse crique Courouaie (affluent basse Approuague), Jan fl, *Oldeman B.2666* (CAY, MICH).

See the discussion of this species above under circumscription of the genus. As noted there, the lateral wings present in the samara of other species have been lost and the dorsal wing is also much reduced, to a crest only 4–5 mm wide. In

contrast to the reduced wings, the nut of the mericarp here is much larger than that of the samaras found in the rest of the genus; even the largest samara found in the other species has a spheroidal nut only 14 mm in diameter, much smaller than the ellipsoidal nut in *L. splendens*. The result is an enlarged unwinged mericarp, surely adapted for dispersal by water. Such shifts from wind-dispersal to water-dispersal have evolved repeatedly in neotropical Malpighiaceae that grow near lowland rivers, at least once in almost every wing-fruited genus. Some examples are *Banisteriopsis sepium* (Adr. Juss.) B. Gates and *Diplopterys cabrerana* (Cuatrec.) B. Gates (Gates 1982), *Hiraea quapara* (Aubl.) Sprague (W. Anderson 1993), *Jubelina riparia* Adr. Juss. in Deless. (W. Anderson 1990a), and *Stigmaphyllon adenodon* Adr. Juss. and *S. lacunosum* Adr. Juss. (C. Anderson 1997).

Of the four known collections of this species, only *Hequet 388* and *Oldeman B.2666* are accompanied by data about the locality or notes on the plant. Oldeman described it as a small tree about 6 m tall, which is a surprise in a genus in which all the other species are woody vines, and Hequet described his collection as a liana. Shifts in habit from vines to small trees do occur in other genera of Malpighiaceae, e.g., *Banisteriopsis* and *Heteropterys*, and in at least one case the shift accompanied the loss of the samara's wing [*Heteropterys laurifolia* (L.) Adr. Juss. to *H. lindeniana* Adr. Juss.; W. Anderson, pers. obs.], so it may be that *Lophopterys splendens* is facultatively arborescent.

Lophopterys surinamensis (Kosterm.) Sandwith, Kew Bull. 1951: 37. 1951. *Dolichopterys surinamensis* Kosterm., Recueil Trav. Bot. Néerl. 32: 279. 1935.—
TYPE: SURINAME. Upper Gran Rio, 6 Mar 1926 fr, *Stahel 223* (holotype: U! [MICH negs. 3493, 3494]; isotype: K!). Fig. 8.

Woody liana; stem hairs dark brown fading to stramineous or gray. Lamina of larger leaves 16–19.7 cm long, 8–10 cm wide, obovate, broadly truncate to subcordate and sometimes unequal at base, nearly plane at margin, very broadly rounded and deeply emarginate at apex, eglandular, glabrate above at maturity except for sparse pubescence persistent along midrib, densely and persistently sericeous below with the rather loose hairs giving the dried leaf a bronze sheen, the 8–11 pairs of lateral veins prominent below, interconnected by prominulous parallel secondary veins, the intricate reticulum prominulous on both sides; petiole 15–20 mm long, persistently sericeous, bearing 1–3 pairs of sunken glands in the distal 2/3 on sides near adaxial edges; stipules not found. Inflorescence persistently subvelutinous with the hairs dark brown, ca. 30 cm long, terminal, a panicle with the pseudoracemes 17–23 cm long and containing ca. 25–50 flowers, the axis 2–4 mm in diameter; bracts and bracteoles abaxially loosely sericeous, mostly deciduous in fruit, triangular, appressed; bracts 2–3 mm long, 1.2–2 mm wide; peduncle 0.4–1 mm long in fruit; bracteoles 1–1.5 mm long, 0.6–1 mm wide; pedicel 6.5–7.6 mm long, 2–2.5 mm in diameter at apex in fruit, velutinous. Anterior sepal broadly triangular, 2 mm long and 2.5 mm wide in fruit, abaxially appressed-tomentose, appressed; lateral sepals not exceeding the glands in fruit; glands 3–4 mm long and wide, transversely elliptical to circular. Petals, androecium, and gynoecium not seen. Samara with the nut spheroidal, 10–14 mm in diameter, smooth on sides and between wings, appressed-tomentose, the hairs brown to stramineous and persistent or patchily deciduous; lateral wings 48–60 mm long, 6.5–11 mm wide, very narrowly elliptical and abruptly narrowed distally to a rounded or obtuse apex, loosely sericeous to glabrate, the hairs stramineous; dorsal wing half-encircling

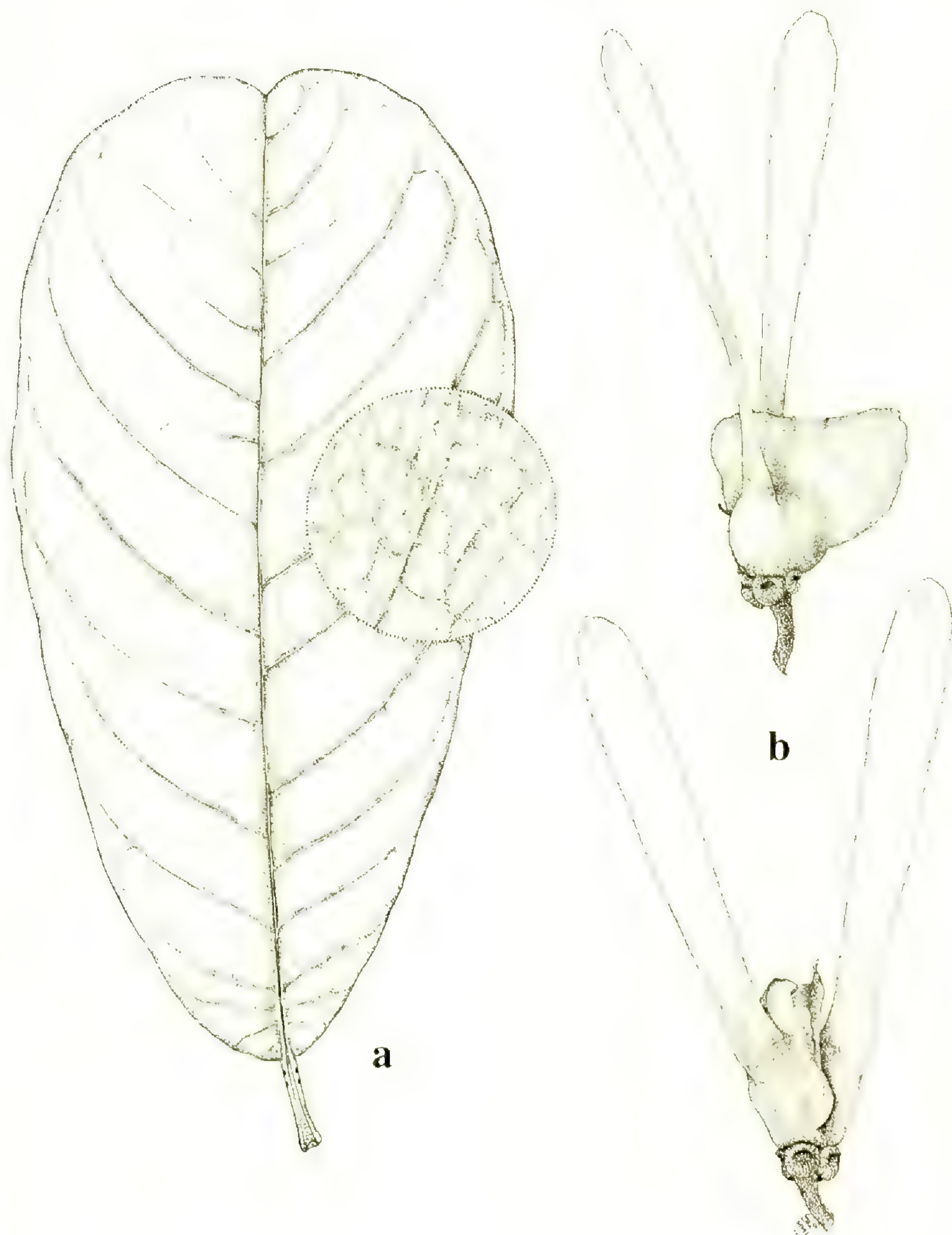


FIG. 8. *Lophopterys surinamensis*. a. Leaf, adaxial view, $\times 0.5$, with enlargement of surface of lamina to show reticulum, $\times$ ca. 5. b. Fruit with only one samara developed, lateral view (above) and abaxial view (below), both $\times 0.8$. (Based on the holotype, *Stahel 223*.)

the nut, trapezoidal-flabellate, 12–15 mm wide, 20–25 mm high, entire or sinuate, loosely sericeous to glabrate; ventral areole 6–7.5 mm high and wide, ovate to subcircular; inner face of seed locule appressed-tomentose.

Phenology. Fruiting in early March.

Distribution (Fig. 1). Known only from the type, from central Suriname.

The type of *Lophopterys surinamensis* bore only submature fruits. Consequently, almost nothing is known about the petals, stamens, and styles in this species. In order to place it in the key to flowering specimens we have had to assume that its anthers are glabrous.

In its inflorescence and fruit this species resembles *L. euryptera* of Guyana and adjacent Venezuela, but it is immediately distinguished by its much smaller leaves with shorter petioles, which resemble those of *L. splendens* of French Guiana. The three species seem to form a complex of the Guianas.

ACKNOWLEDGMENTS

Our beautiful drawings (Figs. 3–8) were all prepared by Karin Douthit with her customary skill and patience. Christiane Anderson made helpful suggestions to improve the text. We acknowledge with thanks the curators of the following herbaria, who made material available for our study in the form of gifts and loans: BHCB, BM, CAY, CEPEC, CTES, F, G, IAN, IBGE, INPA, K, LPB, MBM, MER, MG, MICH, MO, MY, NY, P, PORT, U, UB, ULM, US, VEN, WU.

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MISCELLANEOUS NOTES ON SPHAGNUM—11

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NEW SPECIES

Sphagnum [sect. *Sphagnum*] **lapazense** H. Crum, sp. nov.—TYPE: BOLIVIA. La Paz: Nor Yungas, trail by construction camp, N on Bolivia 1 from La Paz to Nor Yungas, 16°16'89"S, 67°50'89"W, under large rock overhang with running water, 3100–3300 m, 12 Nov 1999, *M. J. Price, S. P. Churchill & Z. Magombo 1236* (holotype: MICH!; isotype: MO!). Fig. 1.

Plantae laete virides, laxe caespitosae, 1.5–4 cm altae. Caules fusci; cellulae epidermidis sine poris, efibrillosae; cylindrus lignosus obscure fuscus. Folia caulina et ramulina persimiles. Rami solitarii vel 2-fasciculati (1 pendens, debilis). Folia 1.3–1.5 mm longa, ovata, concava, apice cucullata, marginibus sulco resoptorio instructa; cellulae hyalinae fibrillosae, non septatae, superficie exteriori pseudoporis paucis, interiore poris 4–9 rotundis annulatis ad commissuras obsitae; cellulae chlorophylliferae sectione transversali ellipticae, interiore foliorum liberae.

Plants blue-green when dry, bright green when moist, in loose tufts 1.5–3 (–4) cm high. Stems dark brown, nearly black; cortex 1-layered, without pores or fibrils; wood cylinder dark brown. Branches single or more often double (1 weak and pendent). Stem and branch leaves similar, 1.3–1.5 mm long, ovate, concave, ± hooded at apex, with a marginal resorption furrow but no membrane gaps at back of the apex; hyaline cells fibrillose throughout, non-septate, on the outer surface with few pseudopores at or near corners, rarely in groups of 2–3 at adjoining ends, on the inner surface with 4–9 round, ringed pores near the commissures; green cells in section elliptic, narrowly exposed on both surfaces, the hyaline cells convex on both surfaces.

ADDITIONAL SPECIMENS EXAMINED. **Bolivia.** La Paz: Nor Yungas, trail by construction camp, N on Bolivia 1 from La Paz to Nor Yungas, 16°16'89"S, 67°50'89"W, under large rock overhang with running water, 3100–3300 m, 12 Nov 1999, *M. J. Price, S. P. Churchill & Z. Magombo 1235* (MICH, MO).

The plants are small and isophyllous, and the leaves have only a few pseudopores on the outer surface but numerous round, ringed pores on the inner. The branches may be single or double, the pendent branch very weak. The unistratose cortical cells of stems and branches lack fibrils and pores. The green cells are narrowly exposed on both surfaces. Because of somewhat cucullate leaves with resorption furrows at the margins, the species clearly belongs in the section *Sphagnum*, although the leaves lack membrane gaps at the back of the apex and fibrils in the stem and branch cortex.

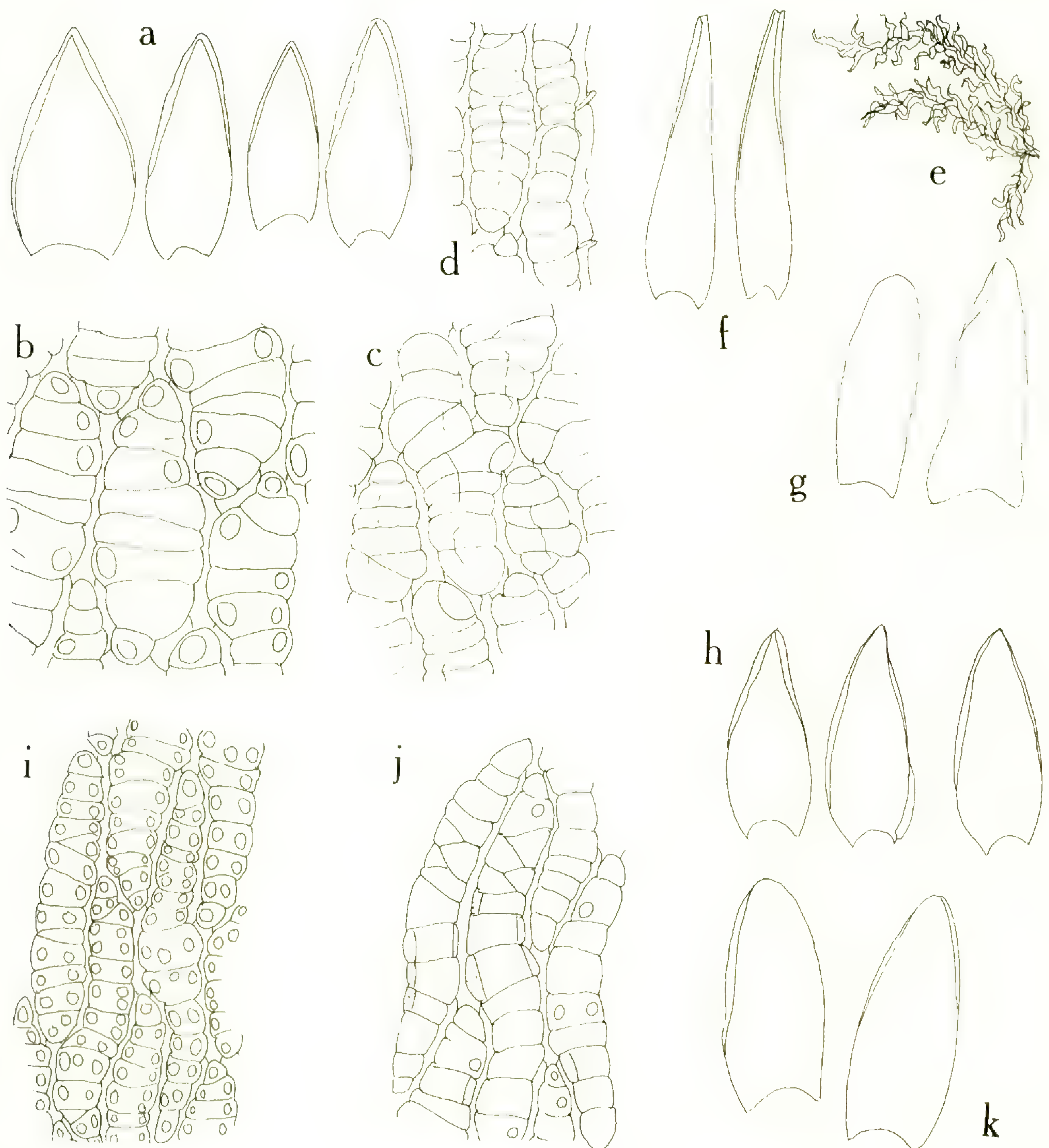


FIG. 1. a-d. *Sphagnum lapazense*. a. Branch leaves, $\times 20$. b. Upper cells of branch leaf, outer surface, $\times 390$. c. Upper cells of branch leaf, inner surface, $\times 390$. d. Upper marginal cells of branch leaf showing marginal resorption furrow, $\times 390$. e-g. *Sphagnum crispatum*. e. Branch fascicle, dry, $\times 5$. f. Branch leaves, $\times 20$. g. Stem leaves, $\times 20$. h-k. *Sphagnum luetzelburgii*. h. Branch leaves, $\times 2$. i. Upper cells of branch leaf, outer surface, $\times 390$. j. Upper cells of branch leaf, inner surface, $\times 390$. k. Stem leaves, $\times 20$.

Sphagnum [sect. *Cuspidata*] ***crispatum*** H. Crum, sp. nov.—TYPE: PERU. Cajamarca: Hualgayoc, Las Lagunas to the west of Cajamaraca, $07^{\circ}10'S$, $78^{\circ}15'W$, 3900 m, 25 May 1973, *P. Hegewald & E. Hegewald* 6213 (holotype: MICH!; isotype: MO!).

Fig. 1.

Plantae parvae, luteae, laxe caespitosae. Caules pallido-luteoli. Folia caulina 1.4–1.6 mm longa, triangulo-lingulata, concavo-acuta; cellulae hyalinae superne fibrillosae, 0–3-septatae, poris nullis vel superficie dorso poris paucis. Rami 2–3-fasciculati (2 patentes). Folia ramulina sicca subtubulosa et valde crispata, 1.5–2 mm

longae, oblongo-ovata, concava, marginibus integris; cellulae hyalinae superne non septatae, superne fibrillosae, poris ut in foliis caulinis, superficie interiore poris nullis; cellulae chlorophylliferae sectione transversali triangulo-trapezoideae, superficie exteriori latiore expositae.

Plants small and slender, 2–5 cm long, in lax, yellow patches. Stems yellowish; cortex 2-layered, without pores at the surface; wood cylinder pale yellow. Stem leaves 1.4–1.6 mm long, triangular-lingulate, concave-acute, narrowly bordered; hyaline cells fibrillose in the upper half, undivided or some leaves on the same stem with some cells 1–3-septate, on the outer surface with pores none or very few, small, round, at or near side corners, on the inner surface with pores none. Branches in fascicles of 2–3 (2 spreading, 1 short, weak, and pendent or lacking). Branch leaves when dry subtubulose, spreading and strongly crisped, when moist erect with curved-spreading, $\pm$ homomallous tips, 1.5–2 mm long, oblong-ovate and concave-tapered to a narrowly truncate, dentate apex, bordered by thick-walled, linear cells in 3–5 rows; hyaline cells fibrillose in the upper 1/2 or less, undivided, otherwise similar to those of stem leaves; green cells in section triangular to trapezoidal, with exclusive or broader exposure on the outer surface, the hyaline cells bulging on both surfaces, somewhat more so on the inner.

The plants are small as compared with those *S. cuspidatum* Ehrh. ex Hoffm., and they have some resemblance to that species, although the branch tips are not particularly tapered and the habitat, aquatic or not, is unknown. The most striking difference is seen in the spreading, strongly crisped branch leaves, when dry. Both stem and branch leaves are fibrillose above and have few or no pores. The hyaline cells of most leaves are undivided but, even on the same stems, some leaves have a few cells that are obliquely divided one to three times.

Sphagnum [sect. *Subsecunda*] **luetzelburgii** H. Paul ex H. Crum, sp. nov.—TYPE: BRAZIL. Rio de Janeiro: Serra dos Orgãos, Schlucht auf der Südseite des Morro Assu, Aug 1915, *Ph. von Luetzelburg 7012* (holotype: MICH!; isotype: M!). Fig. 1.

Plantae obscure fuscae, 3–4 cm altae. Caulis unistratus, sine poris; cylindrus lignosus obscure fuscae. Folia caulina fusca, 1.5 mm longa, concava, elliptica, apice rotunda; cellulae hyalinae aliquando 1-septatae, omnino fibrosae, superficie exteriori poris commissuralibus numerosis, grandiusculis, rotundis, annulatis, etiam poris submedianis, latitudine cellularum subaequantis, interiore poris paucis vel nullis. Rami 2-fasciculati. Folia ramulina 1.4–1.6 mm longa, concava, late ovata; cellulae hyalinae superficie exteriori poris parviusculis, rotundo-ellipticis, annulatis seriebus commissuralibus dispositionibus, etiam poris minutis medianis paucis, interiore poris nullis vel paucis et pseudoporis seriebus brevibus ad commissuras sitis; cellulae chlorophylliferae sectione transversale orciformes, utroque latere folii aequaliter liberae.

Plants dark brown, 3–4 cm high. Stems dark brown; cortical cells in 1 layer, without pores; wood cylinder dark brown. Stem leaves 1.5 mm long, elliptic, concave, broadly rounded at the apex, narrowly bordered; hyaline cells occasionally 1-septate, fibrillose throughout, on the outer surface with numerous rather large, round, ringed pores in interrupted commissural rows and also median pores as wide as cells, often several in a row, on the inner surface with pores none or few. Branches in fascicles of 2, 1 short, stout, and spreading (6 mm long), the other

weaker and $\pm$ spreading. Branch leaves 1.4–1.6 mm long, deeply concave, broadly ovate, broadly pointed, narrowly bordered; hyaline cells on the outer surface with rather small, ringed, rounded-elliptic pores in continuous commissural rows and often some few small, median pores, on the inner surface with pores none or with a few small, round pores at ends and corners and sometimes short rows of pseudopores partitioned off along commissures; green cells barrel-shaped to sub-rectangular, equally exposed on both surfaces, the hyaline cells moderately convex on both surfaces.

The plants are dark brown and short but stout, with short, stout spreading branches. The stem leaves have broad pores on the outer surface, both commissural and median, and the median pores are nearly as wide as the cells and often arranged in a short row. The branch leaves have on the outer surface smaller pores in continuous commissural rows and some few median pores, and on the inner surface they have pores none or few and sometimes short rows of pseudopores partitioned off at the commissures.

Sphagnum [sect. *Subsecunda*] **noryungasense** H. Crum, sp. nov.—TYPE: BOLIVIA. La Paz: Nor Yungas, trail by construction camp N on Bolivia 1 from La Paz to Nor Yungas, 16°16'89"S, 67°50'89"W, secondary humid montane forest, under large rock overhang with running water, 3100–3300 m, 12 Nov 1999, *M. J. Price, S. P. Churchill & Z. Magomba 12347* (holotype: MICH!; isotype: MO!). Fig. 2.

Plantae usque ad 6 cm. altitudine. Caules pallide virides; hyalodermis unistratosa, sine poris; cylindrus lignosus debilis, pallide viridis. Folia caulina 1.2–1.3 mm longa, ovata, concava; cellulae hyalinae fibrillosae usque ad basin, saepe septatae, utroque superficie poris commissuralibus multis. Rami 2-fasciculati (1 pendens). Folia ramulina 1.3–1.8 mm longa, late ovata; cellulae hyalinae superficie exteriori poris et pseudoporis numerosis, interiori poris numerosis, pseudoporis paucis; cellulae chlorophylliferae utroque latere folii anguste expositae.

Plants small (up to about 6 cm high), pale green. Stems pale green; hyaloderm 1-layered, without pores; wood cylinder pale green, scarcely differentiated. Stem leaves much like branch leaves, 1.2–1.3 mm long, ovate, concave, narrowly bordered; hyaline cells fibrillose throughout, often 1-divided, especially toward the base, on the outer surface with numerous elliptic pores and pseudopores at commissures, more numerous pores but few pseudopores on the inner surface. Branches 2-fasciculate (1 weaker and pendent). Branch leaves 1.3–1.8 mm long, broadly ovate; hyaline cells on the outer surface with numerous elliptic pores at the commissures, on the inner surface with numerous pores but few pseudopores scattered at the commissures; green cells narrowly exposed on both surfaces.

The stem and branch leaves are much alike, except that the stem leaves are smaller, with hyaline cells often septate. The hyaloderm is one-layered, and the wood cylinder is scarcely differentiated. The stem leaves have many pores and some pseudopores on both surfaces. The branch leaves have rather few pores and pseudopores on both surfaces, fewer on the inner.

Sphagnum [sect. *Subsecunda*] **hegewaldii** H. Crum, sp. nov.—TYPE: PERU. Amazonas: Chachapoyas District, Las Palmas, zw. Balsas u. Leimemba, 06°46'S, 77°49'W, on soil, 3000 m, 31 Aug 1973, *P. Hegewald & E. Hegewald 7007* (holotype: MICH!; isotype: MO!). Fig. 3.

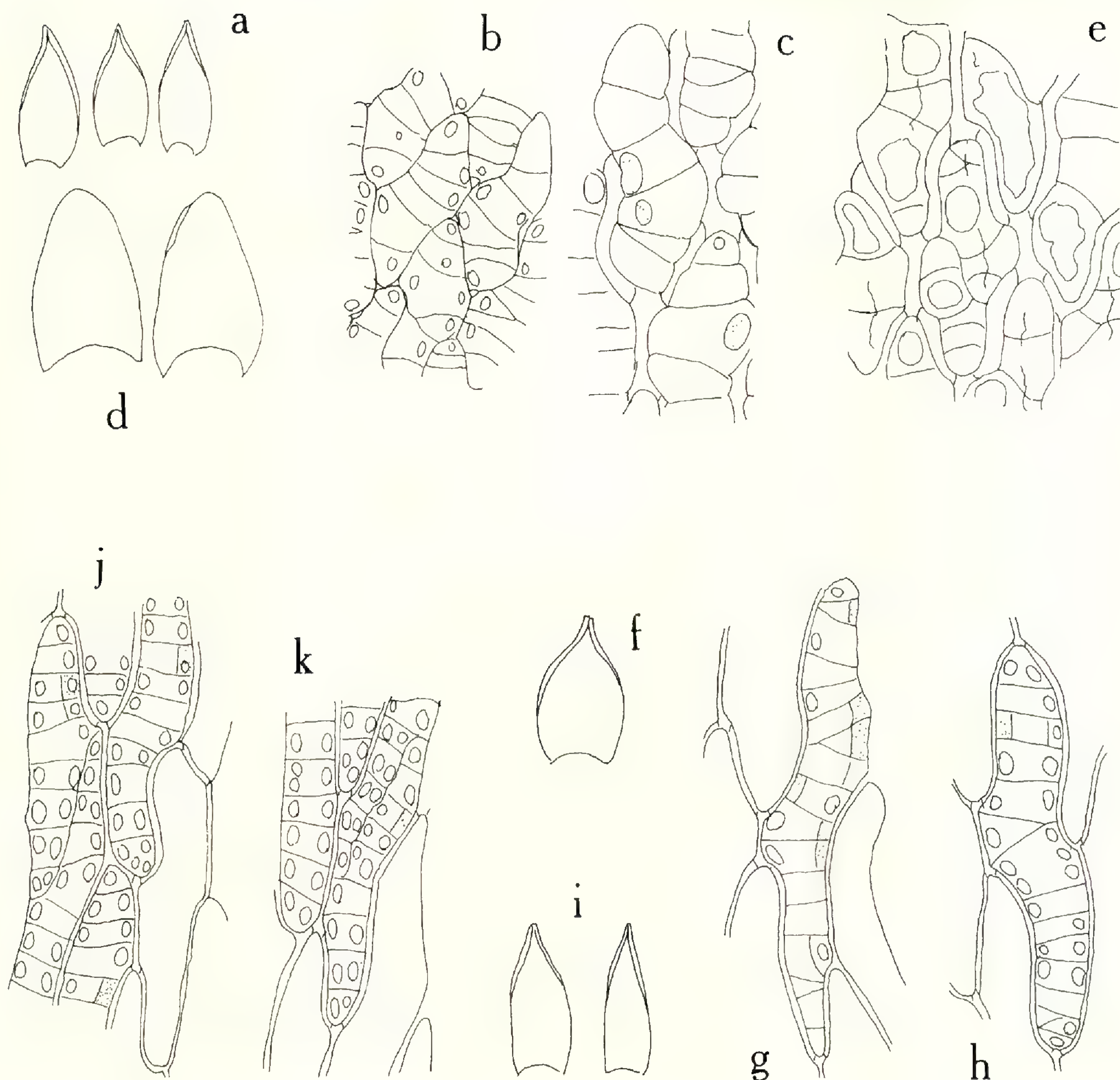


Fig. 2. a–e. *Sphagnum priceae*. a. Branch leaves, $\times 20$. b. Upper cells of branch leaf, outer surface, $\times 390$. c. Upper cells of branch leaf, inner surface, $\times 390$. d. Stem leaves, $\times 20$. e. Upper cells of stem leaf, outer surface, $\times 390$. f–k. *Sphagnum noryungasense*. f. Branch leaf, $\times 20$. g. Upper cells of branch leaf, outer surface, $\times 390$. h. Upper cells of branch leaf, inner surface, $\times 390$. i. Stem leaf, $\times 20$. j. Upper cells of stem leaf, outer surface, $\times 390$. k. Upper cells of stem leaf, inner surface, $\times 390$.

Plantae parvae, obscure rufobrunneae. Hyalodermis caulina unistratosa, sine poris; cylindrus lignosus obscuro-fusca. Folia caulina 1.1–1.3 mm longa, ut ramulina persimiles. Rami 2-fasciculati, uterque patentes. Folia ramulina 1–1.1 mm longa, ovata, concava; cellulae hyalinae superficie exteriori poris ellipticis seriebus commissuralibus, paucifibrillosis, interiore pseudoporis paucis sed fibrillosis multis; cellulae chlorophylliferae sectione transversali utroque latere foliorum anguste liberae sed pariete interiore plus minus longiore.

Plants small (up to 2.5 cm high), dark red-brown above, light brown below. Stem hyaloderm 1-layered, without pores; wood cylinder dark brown. Stem leaves similar to branch leaves but somewhat longer (1.1–1.3 mm long). Branches 2-fasciculate, both spreading, short and equal in length (4–6 mm long), tumid. Branch leaves 1–1.1 mm long, ovate, concave; hyaline cells on the outer surface with elliptic pores in continuous commissural rows but with fibrils none or scarcely present, on the inner surface with commissural pseudopores few or none but

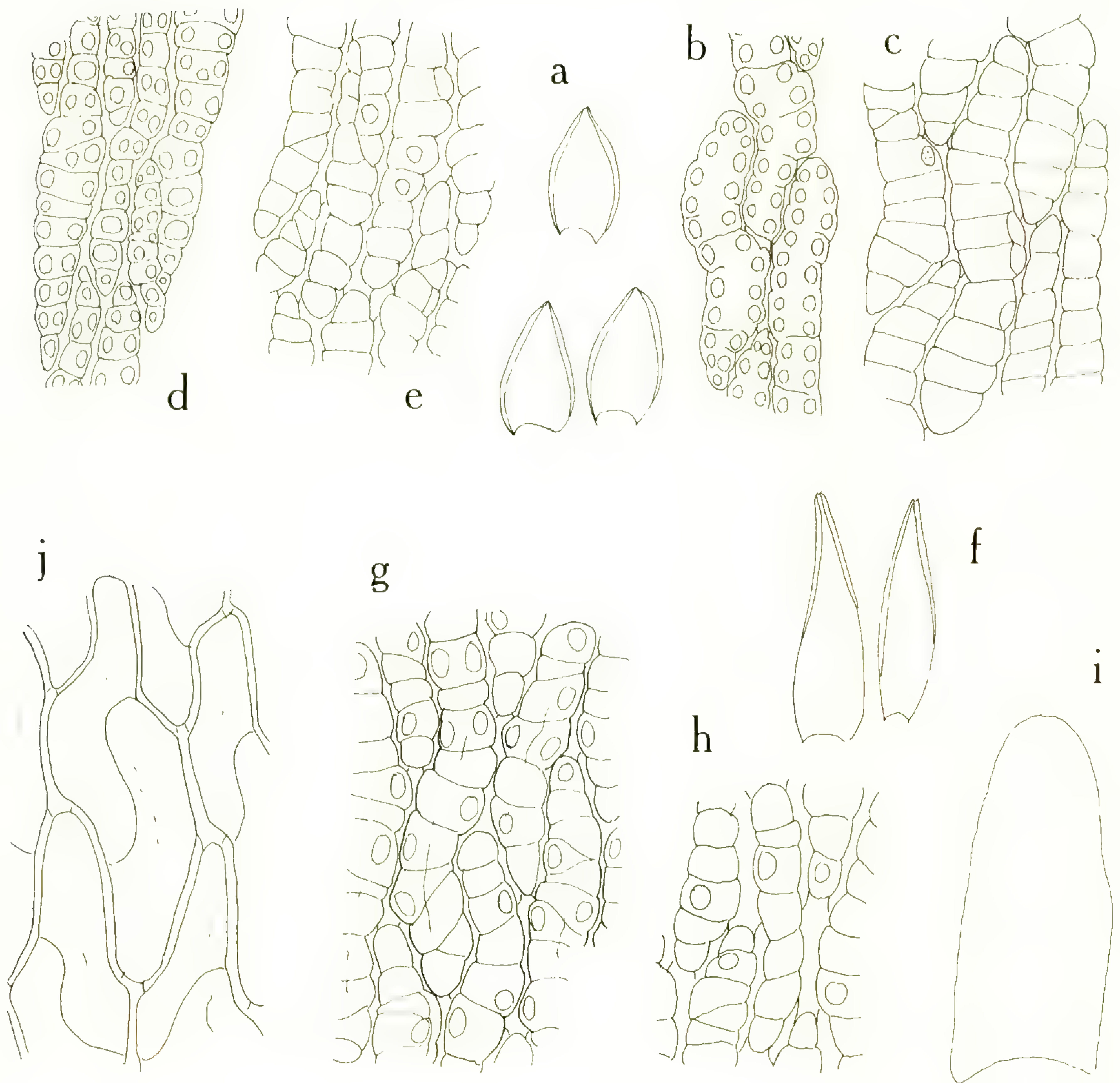


Fig. 3. a–e. *Sphagnum hegewaldii*. a. Branch leaves, $\times 20$. b. Upper cells of branch leaf, outer surface, $\times 390$. c. Upper cells of branch leaf, inner surface, $\times 390$. d. Upper cells of stem leaf, outer surface, $\times 390$. e. Upper cells of stem leaf, inner surface, $\times 390$. f–i. *Sphagnum breedlovei*. f. Branch leaves, $\times 20$. g. Upper cells of branch leaf, outer surface, $\times 390$. h. Upper cells of branch leaf, inner surface, $\times 390$. i. Stem leaf, $\times 20$. j. Upper cells of stem leaf, $\times 390$.

fibrils well developed throughout; green cells narrowly exposed on both surfaces, somewhat more so on the inner.

The plants are small, dark-brown, and shiny, at least when dry. The branches are spreading and only 4–6 mm long. The stem and branch leaves are similar. On the outer surface the hyaline cells have continuous rows of commissural pores, but the fibrils are none or scarcely suggested; on the inner surface there are few or no pseudopores, but the fibrils are well developed.

Sphagnum [sect. *Subsecunda*] ***lojense*** H. Crum, sp. nov.—TYPE: ECUADOR. Loja: Spring bog, on Ona-Saraguro road ca. 3 km S of Carboncillo, 03°S , $79^{\circ}11'\text{W}$, 3000 m, 11 Apr 1998, S. Laegaard 18703B (holotype: MO!).

Plantae graciles. Hyalodermis caulis strato uno, sine poris; cylindrus lignosus pallide luteus. Folia caulina 2–2.2 mm longa, oblong-elliptica, apice obtusa vel

rotundata; cellulae hyalinae usque ad basin fibrillosae, 1–3-septatae, utroque latere poris et pseudoporis paucis. Ramorum fasciculi ramis 5 (3 patentis). Folia ramulina 2.2–2.8 mm longa, rotundato-ovata, breviter concavo-acuta; cellulae hyalinae utroque latere pseudoporis $\pm$ numerosis, commissuralibus; cellulae chlorophylliferae sectione transversali oriciformes, cellulis hyalinis utroque latere convexis.

Plants ca. 6 cm high, in rather compact, bronze to brown masses. Stem hyalodermis 1-layered, without pores; wood cylinder pale yellow. Stem leaves 2–2.2 mm long, oblong-elliptic, rounded at the apex; hyaline cells fibrillose throughout, mostly 1–3-septate, on the outer and inner surfaces with few scattered, commissural pores and pseudopores. Branches crowded, short, stout, often curled at the tips, in fascicles of 5 (3 spreading). Branch leaves not secund, 2.2–2.8 mm long, rounded-ovate, shortly concave-acute; hyaline cells on the outer surface with several to numerous pseudopores at commissures, on the inner surface somewhat fewer; green cells oriciform, equally exposed on both surfaces, the hyaline cells distinctly convex on both surfaces.

ADDITIONAL SPECIMEN EXAMINED. **Ecuador.** Loja: Spring bog, on Ona-Saraguro road ca. 3 km S of Carboncillo, 03°S, 79°11'W, 3000 m, 11 Apr 1998, *S. Laegaard 18703E* (MO).

The plants somewhat resemble species of the section *Sphagnum* because of rather stout branches with rounded-concave leaves. The hyaline cells of stem leaves are mostly 1–3-septate and have only a scattering of commissural pores on both surfaces. The branches are crowded and 5-fasciculate. The hyaline cells of branch leaves have rather numerous commissural pseudopores on both surfaces, and the hyaline cells are distinctly convex above and below.

Sphagnum [sect. *Acutifolia*] **breedlovei** H. Crum, sp. nov.—TYPE: MEXICO. Chiapas: Mpio. Motozintla de Mendoza, near summit of Cerro Mozotal, on rock, 2750 m, 24 Nov 1981, *D. E. Breedlove & B. Bartholomew 55854* (holotype: MICH!; isotype: MO!). Fig. 3.

Plantae graciles, plus minusve 7 cm altae, pallide luteolae. Caules luteoli; cellulae hyalodermidis stratis 3–4, sine poris; cylindrus lignosus luteolus. Folia caulina 2 mm long, longo-lingulata, apice rotunda, anguste limbata; cellulae hyalinae efibrillosae, plerumque 1(–2)-septatae, superficie exteriori membranaceis $\pm$ plicatis. Rami 3-fasciculati. Folia ramulina 1.6–2 mm longa, lanceolata; cellulae hyalinae superficie exteriori membranaceis $\pm$ plicatis, poris commissuralibus pluribus (usque ad 9), interiore poris 0–3 medianis, rotundis, $\pm$ grandiusculis; cellulae chlorophylliferae sectione transversali triangulo-trapezoideae, dorso foliorum inclusae vel utroque liberae.

Plants slender, 7 or more cm high, in yellow, probably dense tufts. Stems yellow; epidermal cells in 3–4 layers, without pores; wood cylinder yellowish. Stem leaves 2 mm long, long-lingulate, rounded at the apex; hyaline cells mostly 1(2)-septate, efibrillose, on the outer surface with some development of membrane pleats. Branches 3-fasciculate (1 pendent). Branch leaves 1.6–2 mm long, lanceolate, bordered by linear cells in 3–4 rows; on the outer surface with 6–9 ringed, elliptic commissural pores of moderate size and some membrane pleats, on the inner surface with 0–3, rounded and rather large, median pores; chlorophyll cells in section triangular-trapezoid, more broadly exposed on the inner surface.

The narrowly lingulate stem leaves, the stem hyalodermis lacking pores, and pores on both surfaces of branch leaves justify recognizing this as a new species. The areolation of stem leaves suggests a relationship to *S. sparsum*, but the absence of pores in the stem cortex and the larger pores on the outer surface of branch leaves are significantly different.

Sphagnum [sect. *Acutifolia*] **priceae** H. Crum, sp. nov.—TYPE: BOLIVIA. La Paz: Nor Yungas, trail by construction camp, N on Bolivia 1 from La Paz to Nor Yungas, 16°16'89"S, 67°50'89"W, secondary, humid montane forest, in clump at edge of trail, 3100–3300 m, 12 Nov 1999, *M. J. Price, S. P. Churchill & Z. Magombo 1268* (holotype: MICH!; isotype: MO!).

Plantae parvae, molles, pallido-incarnatae. Caulis incarnatus; cellulae epidermidis poris nullis; cylindrus lignosus incarnatus. Folia caulina 1 mm longa, fere plana, lingulata vel triangulo-lingulata, anguste limbata, deorsum non dilatata; cellulae hyalinae praecipue efibrillosa (sed apice foliorum fibrillis paucis), saepe 1-septatae, superficie exteriori ad apicem poris rotundis paucis, interiore poris nullis. Rami 4-fasciculati (2 patentes). Folia ramulina 0.7–0.9 mm longa, oblongo-ovata; cellulae hyalinae poris parvis, rotundo-ellipticis, annulatis ad commissuras obsitis, ad apicem aliquando poris submedianis minutis quoque, interiore poris nullis se aliquando pseudoporis commissuralibus; cellulae chlorophylliferae sectione transversale triangulae, interiore foliorum liberae.

Small plants in soft, pinkish tufts. Stems pink; cortex without pores at surface; wood cylinder pink. Stem leaves 1 mm long, nearly plane, lingulate or triangular-lingulate, with border not noticeably broader at base; hyaline cells short at the apex, longer below, often 1-divided, on the outer surface with a few rudimentary fibrils and a few round pores or large gaps near the apex, with membrane pleats, on the inner surface with pores none. Branches 4-fasciculate (2 spreading), the capitulum very small. Branch leaves not 5-ranked, loosely spreading when moist, 0.7–0.9 mm long, oblong-ovate, concave; hyaline cells on the outer surface with small, rounded-elliptic, ringed pores near commissures and corners, at extreme apex also occasionally with 1–2 minute submedian pores, on the inner surface with no pores but occasional pseudopores at commissures; green cells in section triangular, exposed exclusively on the inner surface.

The plants are attractive, small in size and pink in coloration, with leaves spreading when dry. Because the hyaline cells of branch leaves have small pores, the species seems rather like *S. sparsum*, but the stem cortex lacks pores. The stem leaves, smaller than those of *S. sparsum*, are essentially without fibrils, pores, and gaps.

NEW NAMES

Sphagnum [sect. *Acutifolia*] **diblastoides** H. Crum, nom. nov.

Sphagnum austro-americanum H. Crum, Bryologist 98: 588. 1995, non *Sphagnum austro-americanum* H. Crum, 1993.

Sphagnum [sect. *Acutifolia*] **paulianum**, H. Crum, nom. nov.

Sphagnum americanum Warnst., Sphagn. Univ. 132. 1911, nom. nud. prov. *Sphagnum americanum* Paul in Herz., Biblioth. Bot. 88: 3. 1920, non *Sphagnum americanum* Warnst., 1911. *Sphagnum molle* var. *cochabambae* Maass, Nova Hedwigia 12: 85. 1966, nom. nud.

CATALOG OF ACANTHACEAE IN EL SALVADOR

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ABSTRACT. Sixty-seven species in 31 genera of Acanthaceae are documented from El Salvador. Forty-three of these are native to the country, including the following nine species, which are reported from El Salvador for the first time: *Anisacanthus tetracaulis*, *Chileranthemum pyramidatum*, *Dicliptera membranacea*, *D. sp.*, *Dyschoriste hirsutissima*, *Justicia ramosa*, *Ruellia hookeriana*, *R. paniculata*, and *Tetramerium tenuissimum*. Thirty-four (79%) of the native species have been collected in El Salvador since 1960. The catalog of Salvadoran Acanthaceae presented includes the following information for each species: department(s) of occurrence, collections examined, local name(s), and medicinal/economic uses.

INTRODUCTION

El Salvador is the smallest country in Central America (with an area of about 21,000 square kilometers) and the most densely populated (with about 278 people per square kilometer). The country is considered to be generally deforested (Hampshire 1989) with little natural vegetation remaining (Gentry 1978). Although it has not received much attention from the plant taxonomic community in recent years (Bernhardt & Montalvo 1978), renewed collecting activities and a floristic listing project emanating from the Jardín Botánico La Laguna (Anonymous 1993) are currently underway.

Standley and Calderón (1925) listed 2,070 species of flowering plants from the country and Hampshire (1989) estimated that the total might be near 2,500. Recent collections of Acanthaceae from El Salvador have revealed some interesting range extensions for the country. Because many Acanthaceae thrive in disturbed habitats, it is possible that additional members of the family will be found there. Species not yet recorded from El Salvador, but likely to occur there (or to have occurred there prior to the recent extensive deforestation) based on their overall distributions and habitat preferences, include: *Aphelandra aurantiaca* Lindl., *Carlownrightia arizonica* A. Gray, *Hygrophila costata* Nees, *Justicia candelariae* (Oerst.) Leonard, *J. macrantha* Benth., *J. pectoralis* Jacq., *Lepidagathis alopecuroidea* (Vahl) R. Br. ex Griseb., *Poikilacanthus macranthus* Lindau, *Ruellia jussieuoides* Schltdl. & Cham., *R. matagalpae* Lindau, *R. nudiflora* (Engelm. & A. Gray) Urb., *R. stemonacanthoides* (Oerst.) Hemsl., and *Staurogyne agrestis* Leonard.

The following catalog was compiled in an effort to voucher those species of Acanthaceae known from the country, both currently and historically, and to bring their nomenclature up to date. Standley and Calderón (1925) and, subsequently in a revised second edition, Calderón and Standley (1941) listed 37 species of native and exotic Acanthaceae in El Salvador. Guzmán (1950) listed five species of the family as being of some use to man in El Salvador. Leonard (1927), Standley (1930), Carlson (1948), and Daniel (1983, 1993) cited specimens representing other species found in the country. Gibson (1974) and Daniel (1995a) noted the occurrence of several additional species in El Salvador in their distributions of taxa treated from Guatemala and Chiapas respectively, but they did not cite specific

collections from the country. The most recent listing of Acanthaceae in El Salvador is that of Berendsohn and Araniva (1989) who recognized 53 species in the country (including 16 non-native species). Few of the above-mentioned publications on the flora of El Salvador either documented taxa by citing specimens or provided keys for identification of species. The most useful reference for identifying Acanthaceae in El Salvador is the treatment by Gibson (1974) in the *Flora of Guatemala*.

In this annotated catalog 67 species of Acanthaceae in 31 genera are reported from El Salvador, all of which are documented by collections. Forty-three of these species (see Appendix) are considered to be native to the country and 24 are either cultivated or naturalized exotics. Among the native taxa, one genus (*Chileranthemum* Oerst.) and nine species are herewith reported from El Salvador for the first time: *Anisacanthus tetracaulis*, *Chileranthemum pyramidatum*, *Dicliptera membranacea*, *D.* sp., *Dyschoriste hirsutissima*, *Justicia ramosa*, *Ruellia hookeriana*, *R. paniculata*, and *Tetramerium tenuissimum*. Among the exotic species, *Hypoestes phyllostachya* is newly reported as naturalized in the country. Additional exotic Acanthaceae are undoubtedly cultivated in El Salvador.

The types of eight names were collected in El Salvador: *Aphelandra padillana*, *Henrya reticulata*, *H. longipes*, *Justicia salvadorensis*, *J. soliana*, *Sanchezia sprucei* var. *salvadorensis*, *Tetramerium calderonii*, and *T. standleyi*. All were thought to represent taxa endemic to El Salvador at the time of their description. Studies during the past 25 years have shown that there are no species of Acanthaceae endemic to the country, and several species listed below have undoubtedly been extirpated from it through habitat destruction. Of the 43 species of Acanthaceae treated as native in El Salvador, 34 of them (79%) have been collected in the country since 1960 (Appendix).

Figure 1 shows the major political boundaries (departments) within El Salvador and the number of native species of Acanthaceae known from each. The greatest number of species has been collected in western El Salvador (Ahuachapán, Santa Ana, and Sonsonate). The northern contiguous departments of Cabañas, Chalatenango, and Cuscatlán constitute that portion of the country with the fewest collections of Acanthaceae. The reasons for this geographic discrepancy in the distributions of Salvadoran Acanthaceae are not completely understood. The diversity of ecological life zones in the western departments appears to be no greater than that in the northern departments (Holdridge 1978). Further, the diversity of ecological zones in San Salvador is approximately equivalent to that in Cuscatlán (Holdridge 1978); yet 16 species of Acanthaceae are known from the former department and only one from the latter. It appears that the diversity of ecological life zones alone cannot explain the patterns of species richness observed among the departments of El Salvador. Unfortunately, few collections of Acanthaceae from El Salvador provide information on the type of vegetation or ecological zone in which they were collected. According to W. Berendsohn (pers. comm.), one likely explanation for the greater number of collections of Acanthaceae in western El Salvador is the accessibility of this region, which has resulted in its being more thoroughly collected than the northern portions of the country. Other factors that might influence the distribution of Acanthaceae within the country include: 1) the sole occurrence of dry forest ("bosque seco tropical") in northern Santa Ana; and 2) the presence of extensive natural areas in Ahuachapán, Sonsonate, and Santa Ana contrasted with the lack of (or presence of much smaller) such areas in Chalatenango, Cabañas, and Cuscatlán (Morán et al. 1985). In order to understand distribution patterns of Acanthaceae within El Salvador better, additional data on habitat preferences of individual species should be obtained.

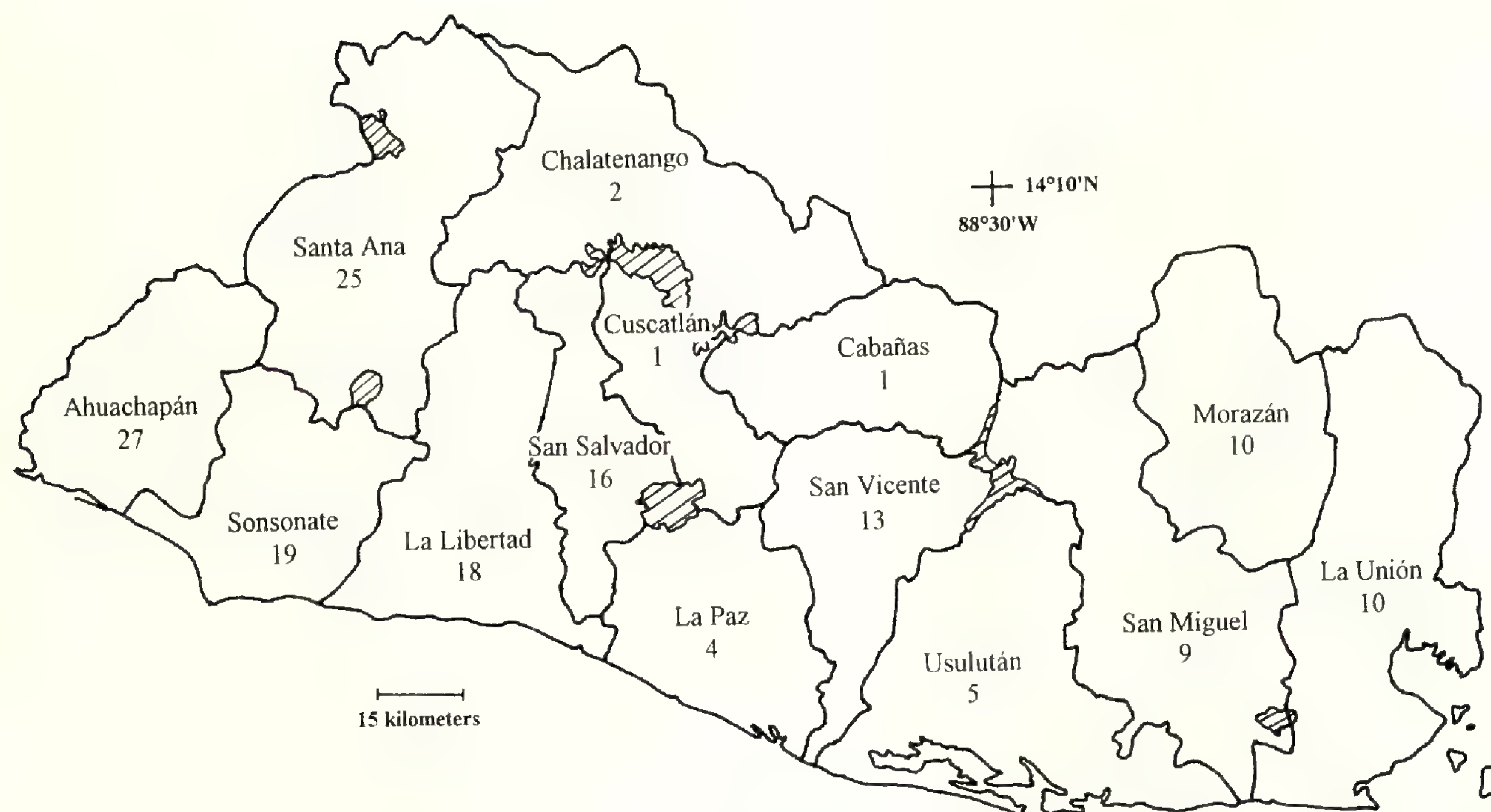


FIG. 1. Map of El Salvador showing political departments and the number of native species of Acanthaceae in each.

The present study reveals that the acanthaceous flora of El Salvador is richer than previously thought. Recent collecting activities show 1) that most of the native taxa collected during the first half of the 20th century are still extant in the country (including some rare species, e.g., *Aphelandra heydeana* and *Carlowrightia hintonii*), and 2) additional taxa not previously known from the country are found there (e.g., *Chileranthemum pyramidatum*). Many of the most commonly collected species are noted to be weedy and/or to grow in disturbed habitats. These tendencies (adaptations) among certain Acanthaceae undoubtedly account for their continued presence in a region with such severe environmental disturbance.

Among the countries of Central America, only Honduras lacks a recent listing of Acanthaceae. A comparison of numbers of native Acanthaceae among the countries in this region reveals that Costa Rica is the most species-rich with 121 (based on Durkee 1986; Gómez-Laurito 1990; Gómez-Laurito & Grayum 1991; Daniel 1993, 1995a; Gómez-Laurito & Hammel 1994; Durkee & McDade 1996), followed by Guatemala with 119 (based on Gibson 1974; Daniel 1990c, 1993, 1995a, 1995c, 1997), Panama with 108 (based on Durkee 1978, 1999; D'Arcy 1987; Daniel & Wasshausen 1990; Daniel 1993; Daniel & McDade 1995), Honduras with 59 (based on Durkee and Daniel's unpublished checklist of Acanthaceae for Flora Mesoamericana), Nicaragua with 57 (based on Durkee 1999, 2001), El Salvador with 43 (see below), and Belize with 40 (based on Daniel 1997).

For each species listed below, the department(s) of occurrence and all collections that I have examined and identified are cited in order to voucher the occurrences and to provide a general indication of distribution within the country. The collections cited likely represent the vast majority of collections of Acanthaceae made in El Salvador. Local names and medicinal or economic uses of the plants as noted on herbarium labels are also given. Identification keys to most of these species can be found in the floristic accounts of nearby regions by Gibson (1974) and Daniel (1995a). Distinguishing features of species not treated in those accounts are provided herein.

CATALOG OF ACANTHACEAE IN EL SALVADOR

Acanthus montanus T. Anderson

LA LIBERTAD: *Berendsohn & Berendsohn* WB 14 (MO); *Montalvo* 6226 (B, MO).

This west African species is cultivated in El Salvador. It can be distinguished from all other Salvadoran Acanthaceae by the combination of its thistlelike habit with mostly radical and pinnatifid leaves, lack of cystoliths, corollas lacking an upper lip, and four monothealous stamens with woolly anthers.

Anisacanthus tetracaulis Leonard

MORAZÁN: *Tucker* 629 (CAS, EAP, LL, MICH, NY, P, PH, UC, US).

This species, originally described from Honduras (Leonard 1950), has not been reported previously from El Salvador. It is not known from either Guatemala or Chiapas and differs from all other Salvadoran Acanthaceae by the following combination of characteristics: shrubs to 3 m; calyx glandular pubescent; corollas red, ca. 2 cm long; stamens 2, staminodes 0; anthers 2-celled with thecae parallel, lacking basal appendages; pollen 3-colporate, 6-pseudocolpate; capsules ca. 15 mm long, glabrous; seeds flattened, ca. 4 mm in diameter.

Aphelandra gigantiflora Lindau

AHUACHAPÁN: *Castillo & López s.n. (ISF00765)* (CAS); *Linares* 875 (EAP); *Linares & Martínez* 1967 (EAP); *Monro et al.* 1934 (CAS, MO), 1991 (B, CAS, MO); *Padilla* V. 418 (US), "chuflete"; *Sandoval & Chinchilla* 31 (B, US), "camarón morado"; *Sandoval & Sandoval s.n. (MS-00240)* (CAS), "camarón rojo," *s.n. (ISB00806)* (B), "camarón rojo"; *Sermeño* 37 (B, MO, US), "camarón grande"; *Standley* 19771 (GH, NY, US), 19972 (US; type of *A. padillana* Standl.); *Standley & Padilla* V. 2583 (EAP, F).—LA LIBERTAD: *Calderón* 1364 (NY, US), 1422 (NY, US); *Carlson* 89 (F, UC); *Montalvo & Villacorta* 6355 (B); *Monro et al.* 2269 (CAS, MO); *Renderos & Villacorta s.n. (RL-00036)* (B, MO), "antorcha"; *Villacorta* 503 (MO, US), "antorcha"; *Weberling* 2155 (M).—SANTA ANA: *Linares & Martínez* 1084 (EAP), 3939 (EAP).—SAN VICENTE: *Iglesias* 3 (F); *Standley* 21512 (GH, NY, US), 21680 (NY, US).—SONSONATE: *Standley* 19315 (NY, US).

Aphelandra heydeana Donn. Sm.

LA LIBERTAD: *Calderón* 1402 (GH, US).—SANTA ANA: *Villacorta & Puig* C. 2406 (EAP, B).

Aphelandra scabra (Vahl) Sm.

AHUACHAPÁN: *Berendsohn et al.* 1438 (B, MO, US), "camarón rojo pequeño"; *Castillo s.n. (ISF00425)* (B), *s.n. (ISF00487)* (CAS), *s.n. (ISF00506)* (B), *s.n. (ISF00546)* (CAS), "cola de camarón," *s.n. (ISF00730)* (CAS), *s.n. (ISF00814)* (CAS), "pitufo"; *Linares & Martínez* 3184 (EAP), 3196a (EAP); *Sandoval s.n. (MS 321)* (CAS), "camarón rojo"; *Sandoval & Linares* 1479 (CAS), "camarón rojo"; *Sandoval & Rivera* D. 1500 (B), "camarón rojo"; *Sandoval & Sandoval* 205 (CAS), "camarón rojo," *s.n. (JBL 1370)* (B, F, MO, US), "camarón rojo," *s.n. (MO)*; *Sermeño* 48 (B, MO, US), "camarón pequeño"; *Standley* 19893 (NY, US); *Standley & Padilla* V. 2883 (EAP, F); *Villacorta & Martínez* 629 (MO, US).—CABAÑAS: *Davidse et al.* 37116 (CAS, MO).—LA LIBERTAD: *Sidwell et al.* 461 (B, CAS, MO).—LA PAZ: *Berendsohn et al.* 1193 (B, US).—LA UNIÓN: *Barclay* 2597 (US); *Grant* 713 (F, MICH); *Standley* 20672 (NY, US), "cordoncillo," 20855 (US), "palo de golpe."—MORAZÁN: *Tucker* 450 (F, LL, MICH, NY, UC, US).—SAN MIGUEL: *Seiler* 808 (F); *Tucker* 931 (F, LL, MICH, NY, PH, UC, US).—SAN SALVADOR: *Calderón* 210 (NY, US); *Standley* 19440 (NY, US).—SANTA ANA: *Linares & Martínez* 974 (EAP), 1156 (EAP), 2060 (EAP).—SAN VICENTE: *Standley* 21220 (US); *Standley &*

Padilla V. 3708 (EAP, F).—SONSONATE: *Standley 22166* (US), “oreja de coyote.”—USULUTÁN: *Carlson 643* (F, UC).

***Aphelandra schiedeana* Schltld. & Cham.**

AHUACHAPÁN: *Molina R. & Montalvo 21799* (EAP, F).—SANTA ANA: *Linares 279* (EAP), “camarón”; *Williams 13563* (EAP, F); *Williams et al. 15159* (EAP, F, MO).—SONSONATE: *Molina R. & Montalvo 21622* (EAP, F, NY); *Renderos & Villacorta 543* (B), “antorcha rosada.”

***Asystasia gangetica* (L.) T. Anderson**

La Libertad: *Montalvo 6243* (B, MO).

This Old World species is cultivated in El Salvador. It is reported as naturalized in various parts of tropical America (e.g., Costa Rica and Panama). It differs from other Salvadoran Acanthaceae by the combination of its herbaceous habit, unilateral racemes, infundibular corolla with ascending cochlear aestivation, four didynamous stamens with ditheous anthers, and four or fewer seeds lacking hygroscopic trichomes.

***Barleria cristata* L.**

LA LIBERTAD: *Berendsohn & Berendsohn WB 12* (MO), *WB 165* (MO); *Villacorta & Renderos s.n. (RV-02603)* (B).—SAN SALVADOR: *Quintana s.n. (JBL 1324)* (B, MO).—SANTA ANA: *Linares & Martínez 842* (EAP), *2193* (EAP).

This Asian species is cultivated in El Salvador; on the label of *Linares & Martínez 842* it is noted that plants grew along a road as a probable escape. The species differs from *B. oenotheroides* by its flowers in leaf axils along the stems (vs. flowers in terminal or subterminal, densely bracteate, four-sided spikes) with blue or white (vs. yellow when fresh) corollas.

***Barleria oenotheroides* Dum. Cours.**

LA UNIÓN: *Standley 20822* (NY, US).—SAN MIGUEL: *Monro et al. 2128* (B, CAS, MO); *Renderos et al. 669* (CAS); *Tucker 954* (EAP, F, LL, MICH, NY, PH, UC, US).—SANTA ANA: *Villacorta & Hernández 1003* (US).—SAN VICENTE: *Standley 21740* (NY, US); *Standley & Padilla V. 3671* (EAP, F).—Dept. unknown: *Calderón 1940* (US).

***Blechum pyramidatum* (Lam.) Urb.**

AHUACHAPÁN: *Chinchilla s.n.* (MO); *Chinchilla & Ch. A. s.n. (ISB00142)* (B, US), “hierba del pollo”; *Guerrero s.n. (ISF00213)* (B, US), “hierba del tunco”; *Linares & Martínez 2014* (EAP); *Martínez s.n. (ISF00033)* (B, MO); *Sandoval & Sandoval 313* (CAS), “hierba buenilla.”—LA LIBERTAD: *Flores s.n. (WB-00405)* (B), “corrimieneto”; *Renderos & Villacorta s.n. (RL-00038)* (B, US); *Villacorta & Berendsohn s.n. (JBL00556)* (MO); *Williams & Molina R. 15067* (EAP, F).—LA PAZ: *Sidwell et al. 621* (CAS).—MORAZÁN: *Tucker 434* (F, LL, MICH, NY, UC, US).—SAN SALVADOR: *Calderón 204* (NY, US); *Carlson 45* (F, UC); *Standley 19132* (US), *19202b* (US), “correflución,” remedy for swellings, *19373* (US); *Villacorta 8140* (US).—SONSONATE: *Molina R. & Montalvo 21702* (EAP, F); *Standley 21835* (US), “cuchansayo,” *22095* (US), “corredora”; *Tucker 1336* (F, MICH, UC, US).

***Bravaisia integerrima* (Spreng.) Standl.**

LA LIBERTAD: *Allen 7201* (EAP, F, LL, MICH, NY, US).—SAN MIGUEL: *Tucker 864* (F, K, MICH, UC, US); *Villacorta 2379* (EAP, B).—USULUTÁN: *Calderón 2138* (GH, US).

Carlowrightia hintonii T. F. Daniel

AHUACHAPÁN: *Chinchilla et al. s.n. (ISB00283)* (B, US), “hierba del coral”; *Sandoval & Chinchilla 186* (B, US), “hierba de corral”; *Standley & Padilla V. 2581* (EAP, F).

A description, illustration, and discussion of this species were provided by Daniel (1983). Although also known from western Mexico, the only known occurrence of *C. hintonii* in Central America is in El Salvador. A key to the three Central American species of *Carlowrightia* was provided by Daniel (1993). *Carlowrightia hintonii* differs from other Salvadoran Acanthaceae by the combination of its white, pseudopapilionaceous corollas; pubescent capsules; and relatively large (4–4.8 mm in diameter), lenticular seeds with a swollen and irregularly pectinate margin.

The species is known only from four collections, the type from Mexico and the three Salvadoran collections cited above. Daniel (1983) discussed the differences between the Mexican and Salvadoran collections known at that time. *Sandoval & Chinchilla 186* and *Chinchilla et al. s.n.* differ from *Standley & Padilla V. 2581* by their cauline pubescence (antrorse and entirely eglandular vs. erect to flexuose and including glandular trichomes). *Sandoval & Chinchilla 186* (collected in 1992) and *Chinchilla et al. s.n.* (collected in 1994) were the first collections of the species from El Salvador in 45 years and represent the rediscovery (and persistence in the country) of a rarely collected species. Additional collections and study of this species are desirable.

Chileranthemum pyramidatum (Lindau) T. F. Daniel

AHUACHAPÁN: *Sandoval & Chinchilla 618* (CAS, MO), “estefanote.”

This is the first report of this genus from El Salvador and the first report of its occurrence south or east of Guatemala. The species can be distinguished from all other Salvadoran Acanthaceae by its androecium of two ditheous stamens and two staminodes, its heterostylous flowers with pink-purple corollas, and its calyces 11–14 mm long with broadly triangular lobes 2–4 mm wide. The only known Salvadoran collection, that cited above, differs from plants occurring in Mexico and Guatemala by its bracteoles, which are lanceolate to lance-subulate and 3.5–8 mm long (vs. triangular-subulate to subulate and 1–4 mm long); calyx with the tube (8–10 vs. 2.5–5 mm long) longer than (vs. shorter than to as long as) the lobes; and capsule with sparse eglandular trichomes distally (vs. glabrous). The specimen of *Sandoval & Chinchilla 618* at MO differs from that at CAS (and from other collections of the species) by its multiflowered (up to 16 flowers vs. 1–3-flowered) dichasia from the axils of distal leaves and bracts (vs. in a terminal thyse). Other aspects of this species were discussed by Daniel (1995b). Additional material from El Salvador is desirable in order to understand better the variation of the species in that country.

Crossandra infundibuliformis Nees

LA LIBERTAD: *Berendsohn & Berendsohn WB 63* (MO); *Montalvo 6239* (B).

This species, native to Africa, Arabia, and the Indian subcontinent, is cultivated in El Salvador. It differs from all other Salvadoran Acanthaceae by the following combination of characters: perennial herbs with long (overtopping vegetative

growth) pedunculate spikes; five heteromorphic calyx lobes; reddish or orangish corollas with a single, five-lobed lip; and four monothecous stamens. The distinctions between the commonly cultivated species *C. nilotica* Oliver and *C. infundibuliformis* were discussed by Daniel and Chuang (1998).

***Dicliptera membranacea* Leonard**

AHUACHAPÁN: *Standley 19809* (GH, US); *Standley & Padilla V. 2600* (F, US).—SONSONATE: *Standley 21828* (GH, NY, US).

These specimens most closely resemble *D. membranacea* among the Central American species of *Dicliptera*. Because the genus is in need of revision, the determination must be considered somewhat tentative. This species has not been reported previously from El Salvador.

***Dicliptera sexangularis* (L.) Juss.**

AHUACHAPÁN: *Molina R. & Montalvo 21815* (EAP, F, NY); *Standley 20224* (US).—LA LIBERTAD: *Standley 23414* (US).—SAN SALVADOR: *Calderón 2076* (US); *Standley 22552* (US), *22689* (US).—SAN VICENTE: *Standley 21415* (US).—SONSONATE: *Standley 21802* (US), “tinta montañas,” *22267* (US), *23435* (US).

On several collections it is noted that the species grows in disturbed habitats or is weedy.

***Dicliptera unguiculata* Nees**

AHUACHAPÁN: *Standley 20030* (NY, US); *Standley & Padilla V. 2730* (F).—SAN SALVADOR: *Calderón 2241* (NY, US).—SANTA ANA: *Linares & Martínez 2086* (EAP).

***Dicliptera* sp.**

MORAZÁN: *Tucker 748* (CAS, UC, US).

This collection from the southern slopes of Mt. Cacaguatique at 1300 meters represents a taxon with similarities to *D. membranacea*. It differs from that species by its larger bracts subtending the cymes ($14\text{--}30 \times 4.5\text{--}11$ vs. $6\text{--}15 \times 3.5\text{--}6$ mm) that are conspicuously petiolate (vs. sessile to subsessile), outer cymule bracteoles ovate to elliptic (vs. obovate to subelliptic), and longer corollas (26–30 mm vs. 16–26 mm). Its taxonomic disposition must await revisionary studies among all of the American species of the genus.

***Dyschoriste hirsutissima* (Nees) Kuntze**

Dept. unknown: “Andes de S. Salvador,” *von Tuerckheim 83039* (MPU).

The exact locality of this collection is unknown to me. Von Tuerckheim collected extensively in portions of Guatemala but was not noted to have collected in El Salvador by Vegter (1988). Whether from Guatemala or El Salvador, this is the first report of the species south of Chiapas, Mexico.

***Dyschoriste quadrangularis* (Oerst.) Kuntze**

AHUACHAPÁN: *Standley 19746* (NY, US).

Elytraria imbricata (Vahl) Pers.

AHUACHAPÁN: *Castillo s.n. (ISF00753)* (CAS); *Chinchilla s.n. (MO)*; *Chinchilla & Ch. A. s.n. (ISB00135)* (B), “coquillo”; *Linares & Martínez 2002* (EAP); *Padilla V. 131* (US), 348 (US), “canutilla,” “tabaquillo,” 430 (US), “coquillo”; *Sandoval & Chinchilla 1503* (B, US), “coquillo”; *Villacorta 654* (MO, US), “culantrillo,” “coquito,” “guacoco.”—LA LIBERTAD: *Campos & Ibarra s.n. (RL-00048)* (B); *Carlson 299* (EAP, F, UC), “guacoquillo”; *Flores s.n. (JBL00588)* (MO), “coquillo”; *Rohweder 3313* (MO); *Villacorta 606* (MO); *Williams & Molina R. 15256* (EAP).—LA UNIÓN: *Grant 710* (F, MICH).—MORAZÁN: *Tucker 467* (F, LL, MICH, NY, P, PH, UC, US).—SAN MIGUEL: *Seiler 804* (F); *Standley 21044* (US), “culantrillo.”—SAN SALVADOR: *Calderón 55* (NY, US), “coquillo”; *Standley 19200a* (US), “coquillo,” crushed leaves and roots used as remedy for pimples, 19456 (US), “coquillo,” remedy for stomach troubles, 22600 (US), “guacoco,” remedy for dysentery; *Velasco 8928* (US).—SANTA ANA: *Berendsohn WB-506* (B, MO); *Linares 669* (EAP).—SAN VICENTE: *Standley 21637* (US), “trencilla.”—SONSONATE: *Standley 21962* (US), “trencilla,” remedy for dysentery, 23532 (NY, US), “cacahuillo.”

Eranthemum pulchellum Andr.

LA LIBERTAD: *Berendsohn & Berendsohn 5* (MO); *Montalvo 6223* (CAS, MO).

This native of the Indian subcontinent is cultivated in El Salvador. It differs from all other Salvadoran Acanthaceae by the combination of its densely bracteate spikes, prominently nervose bracts, blue corollas with contorted aestivation and five subequal lobes, two stamens with ditheous anthers, and two staminodes.

Fittonia albivenis (Lindl. ex Veitch) Brummitt

LA LIBERTAD: *Berendsohn WB 66* (MO), *WB 67* (MO); *Montalvo 6280* (B, MO).

This native of western and northern South America is cultivated in El Salvador. It differs from other Salvadoran Acanthaceae by the combination of its low (often matlike) stature, leaves with prominent reddish or whitish veins, small (ca. 10–15 mm long) and yellowish corollas, and two ditheous stamens.

Graptophyllum pictum (L.) Griff.

SAN VICENTE: *Standley & Padilla V. 3528* (F).

This Papuan species is cultivated in El Salvador. It differs from other Acanthaceae there by the combination of its variegated leaves, calyx 3–5 mm long, metallic pink corollas with a conspicuously funnelform tube and a strongly bilabiate limb, and an androecium of two ditheous stamens and two staminodes. Guzmán (1950) noted that the leaves are used in washing.

Hemigraphis alternata (Burm. f.) T. Anderson

LA LIBERTAD: *Berendsohn 8* (MO).

This species, native to southeastern Asia, is cultivated in El Salvador. It differs from other Salvadoran Acanthaceae by the combination of its creeping habit, cordate leaves with the abaxial surface purplish and the margin crenate, inflorescences of pedunculate spikes, small (ca. 10 mm long) and white corollas with contorted aestivation, four stamens with ditheous anthers, and linear-cylindric capsules less than 10 mm long.

Henrya insularis Nees ex Benth.

AHUACHAPÁN: *Sandoval & Chinchilla 1069* (CAS, MO), “buenilla de altura”; *Sandoval & Sandoval s.n. (ISB00844)* (CAS), “hierba del cadejo falsa”; *Standley 20221* (US; type of *H. reticulata* Happ); *Standley & Padilla V. 2582* (F), *2743* (EAP, F).—CHALATENANGO: *Molina R. & Montalvo 21584* (EAP, F).—LA LIBERTAD: *Villacorta & Lemus 246* (B, F, MO); *Wilbur et al. 16365* (F, MICH, MO).—SAN SALVADOR: *Calderón 2283* (F; type of *H. longipes* Happ); *Standley 20449* (GH, NY, US), *23103* (NY, US).—SAN VICENTE: *Standley 21424* (GH, NY, US); *Standley & Padilla V. 3358* (F), *3583* (EAP, F, UC, US).—SONSONATE: *Standley 21801* (NY, US).

The various forms of this species were discussed by Daniel (1990a).

Hypoestes phyllostachya Baker

LA LIBERTAD: *Flores JF-00143* (MO); *Monro et al. 2323* (B, CAS, MO).

This Malagasy species appears to be both cultivated and naturalized in El Salvador; *Flores 143* is from a botanical garden, whereas *Monro et al. 2323* is noted to be weedy in a cafetal at 1000 m. This commonly cultivated plant is rapidly becoming established in parts of Mexico (Daniel 1995a) and Central America [e.g., Costa Rica: Feldman 1998; Feldman & Haber 1998; Honduras: *Tróchez 244* (MO), *Gutiérrez-Cortines 176* (MO)]. It is easily distinguished from all other Salvadoran Acanthaceae by the combination of leaves with pink spots and two stamens with monothealous anthers. It is described and illustrated by Daniel (1995a).

Justicia aurea Schltdl.

AHUACHAPÁN: *Renderos 110* (B), “antorcha amarilla,” cultivated.—LA LIBERTAD: *Berendsohn 10* (CAS), cultivated, *356* (CAS), cultivated; *Carlson 142* (EAP, F, UC); *Lemus s.n. (Berendsohn 902)* (B, MO).—MORAZÁN: *Tucker 785* (F, MICH, UC, US).—SAN SALVADOR: *Molina R. & Montalvo 21854* (EAP, F, NY); *Standley 20558* (US), *23178* (MO, NY, US).—SANTA ANA: *Linares 324* (EAP); *Williams et al. 15071* (F).—SONSONATE: *Molina R. & Montalvo 21764* (EAP, F).

This species is both cultivated and native in El Salvador. *Renderos 110* has red corollas and conforms to *J. aurea* forma *erythrina* (Standl. & Steyerf.) D. N. Gibson.

Justicia betonica L.

LA LIBERTAD: *Villacorta 243* (MO, US).

This native of the Indian subcontinent is cultivated in El Salvador. The species has not been reported from Chiapas or Guatemala although it is often cultivated for ornament in tropical America and becomes naturalized in some tropical regions (e.g., Hawai'i). It differs from other Salvadoran *Justicia* by its long (up to 16 cm) spikes with white to pinkish (with dark purple markings) corollas subtended by relatively large (ca. 10 mm long) bracts that are white with dark green venation.

Justicia brandegeana Wassh. & L. B. Sm.

LA LIBERTAD: *Berendsohn 13* (MO).

This species is native to the Sierra Madre Oriental of northeastern Mexico and is cultivated in El Salvador. It can be distinguished from native Salvadoran

species of *Justicia* by its dense nodding spikes with ovate, reddish bracts subtending elongate, white (spotted with maroon) corollas.

***Justicia breviflora* (Nees) Rusby**

CUSCATLÁN: *Calderón* 2413 (F; type of *J. salvadorensis* Standl.).

The morphological diversity of *J. breviflora* in southern Mexico and northern Central America was discussed by Daniel (1995a). Study of the holotype of *J. salvadorensis* reveals that it is indistinguishable from *J. breviflora* as currently treated, and the former name is herewith included within the synonymy of the latter.

***Justicia carthagenensis* L.**

AHUACHAPÁN: *Castillo s.n. (ISF00495)* (B), “hierba del susto”; *Chinchilla & Chinchilla R. s.n. (ISB00279)* (CAS, US), “hierba del susto o santísima tr”; *Escobar & Sandoval s.n. (ISB00789)* (B), “hierba de Jesús”; *Sandoval & Chinchilla* 77 (B, US), “santísima trinidad”; *Sermeño s.n. (MO, US)*, “hierba del susto,” “hierba buenilla del susto”; *Standley* 19723 (MO, NY, US), “hierba de la santísima trinidad”; *Standley & Padilla* V. 2600 (EAP); *Villacorta* 2226 (B, MO), “hierba del susto,” cultivated as dooryard plant and used to bathe frightened children.—LA LIBERTAD: *Molina et al.* 16682 (EAP).—LA PAZ: *Berendsohn et al.* 1191 (B, US), “hierba del susto.”—LA UNIÓN: *Grant* 708 (F).—SAN SALVADOR: *Calderón* 199 (US), “hierba del susto,” 1265 (NY, US), “hierba del susto”; *Standley* 19264a (US), “hierba del susto,” remedy for spasms in children, 19432 (NY, US), “hierba del susto.”—SANTA ANA: *Linares* 3958 (EAP); *Linares & Martínez* 3974 (EAP).—SONSONATE: *Standley* 19333 (NY, US), “hierba del susto,” remedy for fits and spasms in children.

Both narrow-leaved individuals (e.g., *Villacorta* 2226) and broad-leaved individuals (e.g., *Berendsohn et al.* 1191) are represented among the Salvadoran collections of this species. Daniel (1995a) discussed narrow-leaved plants of *J. carthagenensis* that were treated by Gibson (1972) as a distinct species, *J. coryni-morpha* D. N. Gibson.

Labels of several Salvadoran specimens note that plants grow in disturbed habitats.

***Justicia colorifera* V. A. W. Graham**

AHUACHAPÁN: *Chinchilla et al. s.n. (ISB00058)* (CAS, US); *Guerrero s.n. (ISF00207)* (B, US), “arbusto de tinta”; *López s.n. (ISF00527)* (B); *Martínez & S.C. s.n. (ISF00025)* (B, US), “tintura de yodo ó cuajátinta,” “planta medicinal para curar catarros, reumatismo, cura el bocio”; *Padilla* V. 96 (US), “sacatinta,” “hierba de Santa Inés,” “hierba de la santísima trinidad,” 340 (US), “sacatinta”; *Sandoval et al. s.n. (ISB00829)* (CAS), “curarina negra”; *Standley* 19715a (US), “saca-tinta,” remedy for gonorrhoea; *Standley & Padilla* V. 2925 (EAP, F).—LA LIBERTAD: *Montalvo* 6232 (B, MO, US), remedy for whooping cough, source of ink; *Sidwell et al.* 484 (CAS, MO).—SAN SALVADOR: *Calderón* 273 (NY, US), “sacatinta”; *Carlson* 492 (F); *Renson* 137 (NY, US), “zaca-tinta”; *Standley* 22795 (MO, NY, US), “saca-tinta.”—SANTA ANA: *Carlson* 750 (F); *Linares & Martínez* 2458 (EAP, MO), 2469 (EAP, MO); *Standley & Padilla* V. 3046 (EAP, F); *Villacorta & Hernández* 990 (B, MO, US), “cuajátinta.”—SAN VICENTE: *Standley* 21411 (NY, US), “saca-tinta”; *Standley & Padilla* V. 3391 (EAP), 3704 (EAP, UC).—SONSONATE: *Pittier* 1970 (NY, US); *Standley* 22154 (NY, US), “saca-tinta”; *Villacorta & Navarrete (RV-02670)* (B).

This species has been commonly confused with *J. spicigera* (see Daniel 1995a). Most Salvadoran collections have been identified as the latter species. Both species are often cultivated in Central America for use as a bluing agent in laundering fabric (based on information on most specimens cited above and in Williams, 1981). Many, but not all, collections were noted to have come from cultivated

plants. Calderón and Standley (1941) questioned whether this species, as *Jacobinia spicigera* (Schltdl.) L. H. Bailey, is native in El Salvador.

Daniel (1995a) noted that plants of this species in Chiapas, Mexico, have red corollas. Some of the Salvadoran collections note that the corollas are red and yellow. Collections of this species with fruits are rare and were unknown to Daniel (1995a). Fruits and seeds are present on both Linares and Martínez collections from Santa Ana and can be described as follows: capsules 15–19 mm long, glabrous, stipe 6–9 mm long, head with a slight medial constriction, 9–10 mm long; seeds 4, $\pm$ flattened laterally (sublenticular), 3–4 mm long, 2.7–3.1 mm wide, surface subrugose, margin $\pm$ tuberculate.

***Justicia comata* (L.) Lam.**

LA UNIÓN: *Calderón* 2372 (F, US); *Standley* 20963 (US).—SANTA ANA: *Standley & Padilla* V. 3097 (EAP, F).—SAN VICENTE: *Fassett* 28345 (F, MICH), 29188 (F, MICH); *Standley* 21446 (US).—USULUTÁN: *Villacorta s.n.* (RV-02602) (B).—Dept. unknown: *Seiler* 590 (F).

***Justicia pectoralis* Jacq.**

LA LIBERTAD: *Villacorta* 2265 (B), “hierba del susto,” used to bathe recently born children as a remedy against fright, cultivated.

This collection was noted to have been cultivated in the Jardín Botánico La Laguna. The same local name and medicinal use ascribed to this species on the specimen label were recorded for *J. carthagenensis* and some confusion may be involved. The sole specimen examined comprises a young plant with floral buds only. The specimen shows one unusual character, the presence at some inflorescence nodes of more than one axillary branch resulting in a subverticillate aspect to some of the branches along the primary inflorescence rachis. This is one of the diagnostic characteristics of *J. comata*, a species often confused with *J. pectoralis*. These two species can be distinguished by the following couplet:

- | | |
|--|----------------------|
| Young stems unifariously pubescent; inflorescence branches usually alternate or opposite at nodes (not appearing verticillate); bracts and bracteoles abaxially glandular; calyx abaxially glandular, lobes unequal with the posterior lobe greatly reduced in size; corolla 7.5–10 mm long, externally pubescent throughout; capsule 5.5–9 mm long. | <i>J. pectoralis</i> |
| Young stems glabrous or sparsely bifariously pubescent; inflorescence branches congested at nodes and appearing verticillate; bracts and bracteoles abaxially eglandular; calyx abaxially glabrous, lobes equal; corolla 3–6 mm long, externally pubescent on anterior side only; capsule 3–4 mm long. | <i>J. comata</i> |

With the exception noted above, *Villacorta* 2265 agrees with *J. pectoralis* in all other characters that can be observed on the specimen. *Justicia pectoralis* is also to be expected as a native plant in noncultivated habitats in the country.

***Justicia ramosa* (Oerst.) V. A. W. Graham**

AHUACHAPÁN: *Serméño* 139 (B, MO, US).

This species has not previously been reported for El Salvador. Daniel (1995a) noted its occurrence in Mexico, Guatemala, Honduras, Costa Rica, and Colombia (based, in part, on information provided by Hilsenbeck, 1983, who treated this species as *Siphonoglossa ramosa* Oerst.).

Justicia soliana Standl.

AHUACHAPÁN: *Berendsohn et al.* 1354 (B, MO, US); *Calderón s.n.* (ISF 826) (CAS), “cuajatinta”; *Chinchilla s.n.* (ISB00106)(B, MO, US), “camaroncillo”; *Chinchilla et al. s.n.* (JBL1418)(B, MO, US); *Chinchilla R. & Pérez s.n.* (ISB00785) (CAS), “camaroncillo”; *Davidse et al.* 37428 (B, CAS, MO); *Linares* 887 (EAP); *Martínez s.n.* (ISF00078), “tinterón”; *Molina R. & Montalvo* 21798 (EAP, F, NY); *Morono et al.* 1906 (CAS, MO), 1986 (CAS, MO); *Padilla V.* 13 (US, in part); *Sandoval s.n.* (MS-357) (CAS), “tinta montés”; *Sandoval & Chinchilla* 38 (B, US), “langosta”; *Sandoval & Sandoval s.n.* (MS-00245) (CAS), “fosforito,” *s.n.* (JBL01366) (CAS, MO), “fosforito de altura”; *Sermeno* 18 (MO, US); *Standley* 19777 (NY, US), 20009 (NY, US), 20056 (NY, US); *Standley & Padilla V.* 2555 (EAP, F, UC), 2669 (EAP, US).—LA LIBERTAD: *Calderón* 1408 (MO, NY, US).—SAN MIGUEL: *Standley* 21149 (NY, US).—SANTA ANA: *del Cid* 1982 (US); *Williams* 13562 (EAP); *Williams et al.* 15171a (EAP), 15183 (EAP, F, MO, US).—SONSONATE: *Linares* 2508 (EAP, MO); *Molina R. & Montalvo* 21599 (EAP, F, NY); *Standley* 19313 (NY, US), 19325 (US; type).

Chinchilla R. & Pérez s.n. lacks the glands on the distal portion of the bracts and bracteoles that are otherwise present in individuals of this species.

Justicia spicigera Schltdl.

SAN SALVADOR: *Renson* 136 (NY, US), used as a bluing agent in laundry.—Dept. unknown: “Amer. centr. Andes de S. Salvador,” *von Tuerckheim* 83038 (MPU).

See above under *J. colorifera*.

Justicia sulphurea (Donn. Sm.) D. N. Gibson

AHUACHAPÁN: *Padilla V.* 40 (US); *Standley* 20141 (GH, NY, US).

Lophostachys guatemalensis Donn. Sm.

AHUACHAPÁN: *Chinchilla s.n.* (ISB00022)(CAS, MO, US), “chorcha de gualchoca”; *Padilla V.* 13 (US, in part), 25 (US), “rayón”; *Sandoval & Chinchilla* 185 (B), “chorcha de gualchoca”; *Sermeno* 70 (B, US), “hierba santa.”—SANTA ANA: *Villacorta & Hernández* 991 (B, MO, US).—SAN VICENTE: *Standley* 21673 (GH, US).—Dept. unknown: *Calderón* 2016 (US).

Megaskepasma erythrochlamys Lindau

LA LIBERTAD: *Berendsohn & Berendsohn* WB 16 (MO), WB 158 (MO); *Montalvo* 6225 (B, MO).—SANTA ANA: *González* 394 (B), “plumero-antorcha roja.”

Although the native range of *M. erythrochlamys* is not known with certainty, this species is usually presumed to have come from northern South America. It appears to be only cultivated in El Salvador; however, on the label of *González* 394 it is noted only that the plant grew along a street. It differs from other genera of Acanthaceae in El Salvador by the combination of its large inflorescences with bright reddish bracts more than 3 cm long, white corollas, and 6- or more-aperturate pollen with the surface covered by discrete insulae.

Nelsonia canescens (Lam.) Spreng.

AHUACHAPÁN: *Chinchilla s.n.* (ISB00195)(B, MO, US), “larva de papaluta”; *Sandoval & Sandoval s.n.* (ISB00818) (B), “hierbabuenilla de costa.”—LA LIBERTAD: *González* 304 (B); *González & Villacorta* 137 (B, US).—LA PAZ: *Calderón* 291 (MO, NY, US).—LA UNIÓN: *Standley* 20933 (NY, US).—SAN MIGUEL: *Standley* 21019 (US).—SAN SALVADOR: *Molina R. & Montalvo* 21539 (EAP, F, NY).—SANTA

ANA: *Standley & Padilla V. 3061* (EAP, F).—SAN VICENTE: *Standley 21181* (MO, NY, US); *Standley & Padilla V. 3679* (EAP, F, US).—SONSONATE: *Standley 21916* (MO, NY, US), *22025* (US), *23441* (MO, NY, US).

This species is not presently known from either Guatemala or Chiapas but might be expected to occur in both. It can be distinguished from other Salvadoran Acanthaceae by the combination of its opposite and evenly dispersed leaves, densely pubescent and densely bracteate spikes, heteromorphic calyx lobes with the anterior pair fused for more than one-half their length, twice divided stigma, and capsules lacking retinacula. Collections note that the species often grows in disturbed habitats where it can be weedy.

Most American specimens have been named either as *N. campestris* R. Br. or *N. brunelloides* (Lam.) Kuntze. Opinion varies as to whether a single variable species (Hossain 1984) or several species (Bremekamp 1964; Barker 1986) should be recognized. The genus appears to be native in Africa, Asia, and Australia. It is not known with certainty whether it is native or introduced in tropical America. Hossain (1984) noted that *N. canescens* is a pantropical weed that was likely introduced into Mexico, Central America, and the West Indies. Humboldt and Bonpland collected it from northern South America in the early 19th century. If introduced into the New World by human activities, it must have been so at a relatively early time. Until additional data are presented on the taxonomy and distribution of the genus, it is here tentatively treated as native in the American tropics.

***Odontonema cuspidatum* (Nees) Kuntze**

SANTA ANA: *Montalvo & de Menjiver 3969* (F).

This species, native to southern Mexico and the West Indies, is cultivated in El Salvador.

***Odontonema tubaeforme* (Bertol.) Kuntze**

AHUACHAPÁN: *Calderón s.n. (ISF00845)* (CAS); *Castillo s.n. (ISF00512)* (B); *Chinchilla & Sandoval s.n. (ISB00175)* (B, MO), “lombricera de altura”; *Chinchilla et al. s.n. (ISB00104)* (CAS), “lombricera roja de altura”; *D.F.M. s.n. (ISF00038)* (B), “cola de camarón”; *F.C.P. & R.A.S. s.n. (ISB00215)* (B, MO), “lombricera roja,” “utilizada como medicinal para expulsar lombrices”; *Padilla V. 14* (US), “flor de chipe,” *19* (US), “San Benito,” *260* (US), “chula”; *Sandoval s.n. (MS-352)* (CAS), “lombricera roja”; *Sandoval & Sandoval 287* (CAS), “lombricera roja,” *s.n. (ISB00794)* (B), “lombricera roja”; *Seiler 940* (F); *Sermeno 38* (B, MO, US), “lombricera”; *Standley 19808* (US), *20155* (NY, US), “palito de coral”; *Standley & Padilla V. 2623* (EAP, F, US).—LA LIBERTAD: *Carlson 83* (EAP, F, UC); *Lemus s.n. (Berendsohn 901)* (B, MO); *Villacorta & Araniva RV-00020* (MO).—MORAZÁN: *Tucker 702* (F, MICH, UC, US).—SAN SALVADOR: *Leppik 20* (EAP); *Molina R. & Montalvo 21850* (EAP, F, NY); *Standley 20539* (US).—SANTA ANA: *Linares 4176* (EAP); *Montalvo & Vargas 3245* (F).—SAN VICENTE: *Standley 21666* (US).—SONSONATE: *Pittier 1944* (NY, US); *Standley 21870* (US).—Dept. unknown: *Calderón 333* (NY, US), “sacatinta montés,” *1969* (US).

Some of the Salvadoran collections (e.g., *Carlson 83*, *Montalvo & Vargas 3245*, *Tucker 702*, and *Villacorta & Araniva RV-00020*) represent the species as circumscribed by Daniel (1995c). However, most of the specimens listed above share similarities with both *O. tubaeforme* and *O. glaberrimum* (M. E. Jones) V. M. Baum, a species of Mexico and Guatemala. They differ from the former and resemble the latter by their glabrous (or nearly so) rachises and opposite dichasia.

They differ from latter and resemble the former by their cauline pubescence (bifarious, retrorse eglandular trichomes 0.2–0.5 mm long) and corollas (i.e., throats 9–11 mm long and limbs 3–5 mm long). Other specimens (e.g., *Pittier 1944*, *Standley 21870*, and *Standley & Padilla V. 2623*) resemble *O. tubaeforme* but apparently lack only the whorled dichasia characteristic of that species. *Sermeno 38* at MO lacks whorled dichasia whereas the specimen at US has them. Both specimens have a glabrous rachis, however. It is not known whether these specimens represent an expression of *O. tubaeforme* that often lacks whorled dichasia and is variable in pubescence, hybrids involving *O. tubaeforme* and *O. glaberrimum*, or one or more other species that remain inadequately circumscribed. Until species limits have been adequately studied in Central American *Odontonema*, all of these collections are tentatively treated as part of a morphologically variable *O. tubaeforme*.

***Pachystachys lutea* Nees**

LA LIBERTAD: *Berendsohn & Berendsohn WB 214* (MO); *Montalvo 6224* (B, MO), “camarón amarillo.”

This native of Peru is cultivated in El Salvador. It differs from other Salvadoran Acanthaceae by the following combination of character states: large (i.e., concealing the calyx and bracteoles), cordate to broadly ovate, and bright yellow bracts arranged in a dense, four-sided terminal spike; large (45–55 mm long) and white corollas; and two stamens with green, ditheous anthers.

***Pseuderanthemum carruthersii* (Seem.) Guillaumin**

LA LIBERTAD: *Choussy 24* (US); *Standley 23667* (US).

This native of the western Pacific region is cultivated in El Salvador. Numerous previously recognized species have been treated recently under this name (e.g., Howard 1989; Fosberg et al. 1993).

***Pseuderanthemum fasciculatum* (Oerst.) Leonard**

AHUACHAPÁN: *Standley & Padilla V. 3013* (EAP, F).—CHALATENANGO: *Tucker 1012* (ARIZ, COLO, EAP, F, GH, LL, MICH, MIN, MO, NY, PH, UC, US).—MORAZÁN: *Seiler 1054* (F).—SANTA ANA: *Carlson 859a* (F), *878* (F, UC); *Molina R. & Molina 12643* (EAP); *Molina R. et al. 16886* (EAP, F).

This species was noted as occurring in El Salvador by Daniel (1995a). Most specimens cited above had been identified as *P. praecox* (Benth.) Leonard, and Gibson (1974) noted the occurrence of *P. praecox* in El Salvador. The putative distinctions between these and other species of *Pseuderanthemum* in northern Latin America are in need of study.

***Pseuderanthemum* sp.**

LA LIBERTAD: *Standley 23680* (US); *Villacorta & López 269* (MO).—SAN SALVADOR: *Calderón 650* (US); *Standley 23631* (GH, NY, US).—Dept. unknown: *Choussy 45* (US).

There is neither a satisfactory treatment of *Pseuderanthemum* nor a revision of the various species of the genus that are cultivated in the New World. These collections, all from cultivated plants, differ somewhat from those of *P. carruthersii*, but determination of their identity or identities must await additional studies of

the genus. Calderón and Standley (1941) listed *P. laxiflorum* (A. Gray) Hubbard, *P. malaccense* Lindau, and *P. pulchellum* Merrill as species cultivated in El Salvador based on several of the collections cited above.

***Ruellia donnell-smithii* Leonard**

AHUACHAPÁN: *Sandoval & Chinchilla* 70 (CAS, US), “hierba de bermuda”; *Standley* 20308 (NY, US); *Standley & Padilla V.* 2844 (EAP, F).—LA LIBERTAD: *Carlson* 189 (F, UC).—SAN SALVADOR: *Standley* 22513 (US).—SONSONATE: *Pittier* 1971 (NY, US); *Standley* 19337 (US), 21759 (NY, US), 22099 (NY, US), 23446 (US).—Dept. unknown: *Calderón* 1908 (US).

***Ruellia geminiflora* H. B. K.**

Morazán: *González* 147 (B).—SAN SALVADOR: *Renson* 269 (NY, US).—SANTA ANA: *Standley* 20392 (GH, US).

On the label of *González* 147 unspecified medicinal uses are noted for this species. Guzmán (1950) reported that the roots are dried and made into a powder that is efficacious as an emetic and that an alcoholic tincture made from the plant is useful for chronic jaundice and intestinal obstructions.

***Ruellia hookeriana* (Nees) Hemsl.**

SANTA ANA: *Calderón* 985 (US); *Davidse & Pohl* 2065 (MO); *Linares* 571 (EAP); *Linares & Martínez* 2894 (EAP); *Standley* 20414 (US).—Dept. unknown: *Choussy* 69 (US).

El Salvador was included within the range of this species by Daniel (1995a), and the specimens cited above substantiate its occurrence there for the first time.

***Ruellia inundata* H. B. K.**

AHUACHAPÁN: *Castillo s.n.* (ISF00813) (CAS), “hierba del cadejo”; *Chinchilla s.n.* (ISB00346) (B, US), “hierba del cadejo”; *Linares & Martínez* 1974 (EAP); *Sandoval & Chinchilla* 157 (B, MO, US), “hierba del cadejo”; *Sandoval & Sandoval* 244 (CAS), “hierba del cadejo”; *Standley* 19915 (NY, US), 20031 (US), “hierba de cabra”; *Villacorta & Martínez* 641 (MO, US).—LA LIBERTAD: *Cruz s.n.* (*Berendsohn* 472) (B); *Molina R. et al.* 16686 (EAP, F, NY); *Villacorta & Berendsohn* 1035 (B, MO).—LA UNIÓN: *Beetle* 26266 (US); *Grant* 712 (F, MICH), 729 (F); *Standley* 20665 (NY, US), “chancho de monte.”—SAN MIGUEL: *Tucker* 885 (F, MICH, UC, US).—SAN SALVADOR: *Calderón* 225 (NY, US); *Renson* 109 (NY, US); *Standley* 19443 (NY, US).—SANTA ANA: *Berendsohn* 505 (B, MO); *Linares* 354 (EAP), 2133 (EAP).—SAN VICENTE: *Standley* 21257 (US); *Standley & Padilla V.* 3457 (EAP, F).—SONSONATE: *González* 74 (B, US); *Standley* 21902 (US).—USULUTÁN: *Carlson* 650 (F).

***Ruellia malacosperma* Greenm.**

SAN SALVADOR: *Calderón* 570 (GH, US), “ala de angel”; *Standley* 22636 (GH, NY, US), “campanilla ala de angel.”

The collections cited above were noted as either cultivated or found in a garden. Daniel (1995a) discussed this species and its close relative *R. coerulea* Morong (= *R. brittoniana* Leonard).

***Ruellia megasphaera* Lindau**

AHUACHAPÁN: *Standley* 19968 (US).—SAN SALVADOR: *Standley* 20498 (GH, NY, US).—SANTA ANA: *Villacorta & Hernández* 989 (B, MO, US).—SONSONATE: *Pittier* 1967 (US).

Ruellia metallica Leonard

AHUACHAPÁN: *Sandoval & Román 1496* (CAS, US), “gualchoca”; *Sermeño 93* (B, MO), “hierba de talepate”; *Standley 19772* (NY, US), *20171* (US), *20276* (NY, US).—SONSONATE: *Tucker 1335* (F, MICH, UC, US).

Some of the specimens cited above do not show well the linear to lanceolate terminal bracts usually attributed to the species. *Tucker 1335* at MICH has ovate to lanceolate to elliptic bracts, however, that are similar to bracts seen in other specimens of this species, and *Standley 19772* shows the typical terminal bracts.

Ruellia paniculata L.

LA UNIÓN: *Carlson 666* (EAP, F, UC); *Davidse et al. 37349* (CAS, MO).—SANTA ANA: *Carlson 1008* (F).

This species has not been reported previously from El Salvador.

Ruellia puberula (Leonard) Tharp & F. A. Barkley

LA UNIÓN: *Calderón 2368* (F); *Williams & Molina R. 16728* (EAP, F).—SAN MIGUEL: *Standley 21051* (US).—SANTA ANA: *Calderón 2184* (US); *Linares 2640* (EAP, MO); *Standley & Padilla V. 3245* (F).

This taxon was first reported from El Salvador by Leonard (1927) as *R. nudiflora* var. *puberula* Leonard. As interpreted here, *R. puberula* shows morphological variation that has not been adequately studied. *Standley & Padilla V. 3245* at F differs from most of the other collections by having entirely eglandular calyces (cf. discussion of *R. puberula* in Daniel, 1995a). Calyces of the other specimens are glandular except for *Calderón 2368*, which has one plant with glandular calyces and another plant with eglandular calyces. *Calderón 2368* and *Williams & Molina R. 16728* differ from the other collections cited by their near or complete lack of glandular trichomes on the young stems. In this regard, these two specimens agree with the description of the species provided by Daniel (1995a) for Chiapan plants. Daniel (1995a) discussed some of the distinctions between this species and both *R. nudiflora* and *R. intermedia*. *Ruellia puberula* would appear to differ from the widespread *R. nudiflora* principally by its lack of a terminal glandular thyrse and its mostly eglandular capsules. Additional studies of species boundaries in this complex are desirable.

Sanchezia parvibracteata Sprague & Hutch.

AHUACHAPÁN: *Padilla V. 173* (US).—LA LIBERTAD: *Berendsohn 9* (MO); *Carlson 282* (EAP, F).—SAN SALVADOR: *Calderón 588* (NY, US); *Standley 19362* (NY, US); *Velasco 8985* (US; type of *S. sprucei* var. *salvadorensis* Donn. Sm.).

This tropical American native is cultivated in El Salvador.

Stenandrium pedunculatum (Donn. Sm.) Leonard

SANTA ANA: *Linares 589* (EAP); *Weberling & Schwanitz 2273* (M).

This species was reported from El Salvador by Daniel (1993), who also provided a key to the three species of *Stenandrium* occurring in Central America.

Tetramerium nemorum Brandegee

SANTA ANA: *Standley & Padilla V. 3220a* (EAP, F, US).

This species was figured and listed as occurring in El Salvador by Gibson (1974) under the name *Averia longipes* (Standl.) Leonard. See Daniel (1986) for a discussion of *Averia* Leonard.

Tetramerium nervosum Nees

AHUACHAPÁN: *Sandoval s.n. (MS-319)* (CAS), “hierba de pollo”; *Sandoval & Chinchilla 141* (CAS, MO), “crisalia”; *Sandoval & Román 1509* (CAS), “pollo de altura”; *Sandoval & Sandoval 260* (CAS), “hierba buenilla de montaña”; *Standley & Padilla V. 2422* (EAP), 2874 (EAP); *Villacorta & Sandoval 949* (B, MO, US).—LA LIBERTAD: *Molina R. et al. 16689* (EAP, F, NY, US); *Villacorta 222* (MO, US); *Williams & Molina R. 15039* (EAP).—LA UNIÓN: *Grant 723* (A, F, MICH); *Standley 20680* (US; type of *T. standleyi* Happ).—MORAZÁN: *Tucker 474* (US), 512 (F, K, LL, MICH, NY, PH, UC, US).—SAN MIGUEL: *Calderón 2113* (US), 2123 (GH, US); *Standley 21057* (US).—SANTA ANA: *Linares & Martínez 1242* (EAP), 3117 (EAP); *Standley 19705* (NY, US); *Standley & Padilla V. 3049* (EAP, F, US).—SAN VICENTE: *Standley 21171* (GH, US); *Standley & Padilla V. 3347* (EAP), 3418 (EAP), 3514 (EAP); *Williams 13586* (EAP).—SONSONATE: *Standley 21770* (GH, US).—USulután: *Calderón 2098* (NY; type of *T. calderonii* Happ).—Dept. unknown: *Calderón 1929* (US).

The morphological forms of this variable species were discussed by Daniel (1986).

Tetramerium tenuissimum Rose

AHUACHAPÁN: *Linares & Martínez 1981* (EAP), 3212 (EAP); *Standley 19736* (MO, US).—LA LIBERTAD: *Villacorta 222* (B, MO, US).

This species is here newly reported for El Salvador. *Standley 19736* was treated by Daniel (1986) as *T. nervosum*. Further study of this collection reveals it to have five calyx lobes, pubescent capsules, and small bracts with short-ciliate margins; thus, it is referable to *T. tenuissimum* rather than *T. nervosum*.

Thunbergia alata Bojer

LA LIBERTAD: *González 307* (EAP, B); *Montalvo 6282* (B); *Rohweder 3271* (MO).—SAN SALVADOR: *Calderón 1173* (US), 1335 (US), 1805 (US).

This African species is cultivated and has become naturalized in numerous parts of tropical America. It is known both as a cultivated plant and as an escape from cultivation in El Salvador.

Thunbergia erecta (Benth.) T. Anderson

LA LIBERTAD: *Carlson 315* (F).—SAN SALVADOR: *Calderón 1171* (NY, US), 1344 (NY, US); *Standley 19378* (US), “nazaret, cuerno.”

This African species is cultivated in El Salvador.

Thunbergia fragrans Roxb.

SANTA ANA: *Standley & Padilla V. 3099* (EAP, F, US).

This Asian species is cultivated and sometimes becomes naturalized in the American tropics. The collection cited above was noted to be an escape from cultivation.

Thunbergia grandiflora Roxb.

AHUACHAPÁN: *Padilla* V. 332 (US), “Emperatriz Eugenia,” 474 (US), “Emperatriz Eugenia.”—LA LIBERTAD: *Villacorta* 135 (MO), “Emperatriz Eugenia.”—SAN SALVADOR: *Leppik* 10 (EAP).

This Asian native sometimes becomes naturalized in tropical regions. *Padilla* V. 332 was specifically noted to have been cultivated. The author of the name for this species is sometimes given as “(Roxb. ex Rottler) Roxb.” Wood (1994) argued that the earliest valid publication of a name for the species was by Roxburgh in 1820.

Thunbergia laurifolia Lindl.

AHUACHAPÁN: *Standley & Padilla* V. 2732 (F).—SAN SALVADOR: *Calderón* 1818 (US); *Standley* 20596 (NY, US), “Santa Cecilia.”

This Asian species is cultivated in El Salvador.

EXCLUDED TAXA AND NAMES

The following names have been attributed to plants occurring in El Salvador by various authors. They are excluded from the list above with a rationale provided.

Aphelandra deppeana Schltdl. & Cham.—Synonym of *A. scabra* (Daniel 1991).

Aphelandra padillana Standl.—Synonym of *A. gigantiflora* (Daniel 1991).

Aphelandra schiedeana var. *gigantiflora* (Lindau) D. N. Gibson.—Synonym of *A. gigantiflora* (Daniel 1991).

Averia longipes (Standl.) Leonard.—Synonym of *Tetramerium nemorum* (Daniel 1986).

Barleria micans Nees.—Synonym of *B. oenotheroides* (Daniel 1995b).

Blechnum brownei Juss.—Synonym of *B. pyramidatum* (Daniel 1995b).

Bravaisia floribunda DC.—Synonym of *B. integerrima* (Daniel 1988).

Dianthera sulphurea Donn. Sm.—Synonym of *Justicia sulphurea* (Gibson 1974).

Dicliptera acuminata Juss.—This species was listed by Calderón and Standley (1941). Plants here treated as *D. membranacea* were originally identified as *D. acuminata*. Plants conforming to *D. acuminata* have not been observed from El Salvador.

Dicliptera assurgens (L.) Juss.—Synonym of *D. sexangularis* (Daniel 1995a).

Dyschoriste bilabiata (Seem.) Kuntze.—This species was included from El Salvador by Calderón and Standley (1941). The specimen annotated with this name by Standley is treated above as *D. quadrangularis*. Daniel (1995a) treated *D. bilabiata* as a synonym of *D. hirsutissima*.

Elytraria squamosa (Jacq.) Lindau.—Synonym of *E. imbricata* (Daniel 1995a).

Eranthemum nervosum (Vahl) R. Br. ex Roem. & Schult.—Synonym of *E. pulchellum* Andr. (Fosberg et al. 1993).

Henrya imbricans Donn. Sm.—Synonym of *H. insularis* (Daniel 1990a).

Henrya scorpioides (L.) Nees.—Gibson (1974) included El Salvador within the range of the species sometimes given this name. Plants treated with this name are usually referable to *H. insularis*. The basionym of *H. scorpioides* pertains to a species of *Dicliptera* (Daniel 1990a).

Jacobinia aurea (Schltdl.) Hemsl.—Synonym of *Justicia aurea* (Daniel 1995a).

Jacobinia macrantha (Benth.) Benth. & Hook. f.—This name, listed by Guzmán (1950), is a synonym of *Justicia macrantha* Benth., which is presently known only from Chiapas, Guatemala, Costa Rica, and Panama (Daniel 1995a). *Justicia macrantha* might occur (or might have occurred at one time) in El Salvador, but I have seen no specimens of it from that country. Guzmán's sketchy description (which is suggestive of *J. colorifera*) and a specimen of *J. colorifera* at US annotated as *Jacobinia macrantha* both suggest inclusion of *J. macrantha* based on a misidentification. Interestingly, *J. macrantha* was listed along with *J. spicigera* and *J. colorifera* [as *J. tinctoria* (Oerst.) D. N. Gibson] by Williams (1981) as a source of a bluing agent used in the laundering of fabric in Central America.

Jacobinia spicigera (Schltdl.) L. H. Bailey.—Synonym of *Justicia spicigera* (Daniel 1995a); the name was apparently misapplied to *J. colorifera* by Calderón and Standley (1941).

Justicia corynimorpha D. N. Gibson.—Synonym of *J. carthagenensis* (Daniel 1995a).

Justicia ecbolium L.—This name, listed by Guzmán (1950), is a synonym of the Asian species *Ecbolium ligustrinum* (Vahl) Vollesen (Vollesen 1989). Based on the description, local name, and economic uses he provided, Guzmán (1950) was undoubtedly referring to either *Justicia spicigera* or *J. colorifera*.

Justicia fulvicoma Schltdl.—Berendsohn and Araniva (1989) listed this species as occurring in El Salvador and noted that it was not native there. Gibson (1974) treated *J. fulvicoma* in a broad sense (e.g., *J. brandegeana* was listed in synonymy). Daniel (1989) rejected Gibson's concept of the species and treated *J. fulvicoma* as restricted to northeastern Mexico. The species is sometimes grown for ornament and might be cultivated in El Salvador. The basis for inclusion of this name by Berendsohn and Araniva's (1989) was likely a cultivated plant of *J. brandegeana* (see above).

Justicia peckii (S. F. Blake) Standl.—Synonym of *J. breviflora* (Daniel 1995a).

Justicia salvadorensis Standl.—Synonym of *J. breviflora*, see above.

Nelsonia brunelloides (Lam.) Kuntze.—This name was used by Calderón and Standley (1941) and has been treated as a synonym of *N. canescens* (e.g., Hossain 1984). According to Bremekamp (1944) its basionym apparently applies to a species of *Hemigraphis*.

Odontonema callistachyum (Schltdl. & Cham.) Kuntze.—This species was listed as occurring in El Salvador by Gibson (1974) and Berendsohn and Araniva (1989) based on a very broad concept of the species. According to Daniel (1995c), it is not known from the country.

Odontonema strictum (Nees) Kuntze.—Synonym of *O. tubaeforme* (Daniel 1995c).

Pseuderanthemum laxiflorum (A. Gray) F. T. Hubb.—See above under *P. sp.*

Pseuderanthemum malaccense Lindau.—See above under *P. sp.*

Pseuderanthemum praecox (Benth.) Leonard.—See above under *P. fasciculatum*.

Pseuderanthemum pulchellum Merr.—See above under *P. sp.* Merrill's name, *P. pulchellum* (Hort.) Merrill, was a new combination based either on *Eranthemum pulchellum* Andr. or a later homonym of it that pertained to the same species.

Ruellia albicaulis Bertero.—Synonym of *R. inundata* (Daniel 1995a).

Ruellia humifusa (Oerst.) Hemsl.—This name, listed by Calderón and Standley (1941), is a later homonym of *R. humifusa* Pers. They likely applied it to one or more collections of *Ruellia* that are here treated as a different species.

Ruellia nudiflora (Engelm. & A. Gray) Urb.—This species was attributed to El Salvador by Daniel (1995a) and several specimens bear this name. These are here treated under *R. puberula*. *Ruellia nudiflora* might be expected to occur in the country.

Ruellia parva (Nees) Hemsl.—Gibson (1974) used this name for plants here referred to *R. megasphaera* (see Daniel 1990b).

Ruellia stemonacanthoides (Oerst.) Hemsl.—This species was included by Calderón and Standley (1941), Gibson (1974), and Daniel (1995a). It is to be expected in El Salvador, but all specimens identified with this name have been referred to other species here (e.g., *R. donnell-smithii*, *R. metallica*).

Ruellia tuberosa L.—This species was included by Calderón and Standley (1941) but no Salvadoran specimens of it have been seen. Their inclusion of it was likely based on *Calderón 2368* which bears this name, but is treated above as *R. puberula*.

Sanchezia sprucei var. *salvadorensis* Donn. Sm.—Synonym of *S. parvibracteata* (Daniel 1995a).

Tetramerium hispidum Nees.—Synonym of *T. nervosum* Nees (Daniel 1986).

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APPENDIX

RELATIVE DATES OF COLLECTION OF NATIVE SALVADORAN ACANTHACEAE

Species known only from collections made prior to 1960:

Anisacanthus tetracaulis, *Dicliptera membranacea*, *Dicliptera* sp., *Dyschoriste hirsutissima*, *Dyschoriste quadrangularis*, *Justicia breviflora*, *Justicia spicigera*, *Justicia sulphurea*, *Tetramerium nemorum*.

Species collected at least once since 1 January 1960:

Aphelandra gigantiflora, *Aphelandra heydeana*, *Aphelandra scabra*, *Aphelandra schiedeana*, *Barleria oenotheroides*, *Blechum pyramidatum*, *Bravaisia integerrima*, *Carlowrightia hintonii*, *Chileranthemum pyramidatum*, *Dicliptera sexangularis*, *Dicliptera unguiculata*, *Elytraria imbricata*, *Henrya insularis*, *Justicia aurea*, *Justicia carthagenensis*, *Justicia colorifera*, *Justicia comata*, *Justicia ramosa*, *Justicia soliana*, *Lophostachys guatemalensis*, *Nelsonia canescens*, *Odontonema tubaeforme*, *Pseuderanthemum fasciculatum*, *Ruellia donnell-smithii*, *Ruellia geminiflora*, *Ruellia hookeriana*, *Ruellia inundata*, *Ruellia megasphaera*, *Ruellia metallica*, *Ruellia paniculata*, *Ruellia puberula*, *Stenandrium pedunculatum*, *Tetramerium nervosum*, *Tetramerium tenuissimum*.

STREBLACANTHUS MONOSPERMUS (ACANTHACEAE), A GENUS AND SPECIES NEW TO THE FLORA OF MEXICO

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ABSTRACT. *Streblacanthus monospermus* is documented from Mexico and North America for the first time. The species, previously known only from lowland rain forests in Costa Rica and Panama, was recently collected in the Chimalapa region of Oaxaca. Affinities of *Streblacanthus* and distinctive characteristics of *S. monospermus* within the genus are noted.

Recent collecting activities in the lowland rain forests of southern Mexico, particularly the Uxpanapa region of southeastern Veracruz and the Chimalapa region of adjacent Oaxaca, have resulted in several geographic range extensions and new taxa of Acanthaceae (e.g., Daniel 1991, 1999). Herewith, the genus *Streblacanthus* is reported from Mexico and North America for the first time based on a collection from the Chimalapa region of Oaxaca. The rarely collected and little-known species, *S. monospermus*, is described and illustrated.

Streblacanthus has been treated as a tropical American genus of four species that range from northern Argentina to southeastern Costa Rica (Daniel 1996). Lindau (1895) placed the genus in his tribe Odontonemeae, subtribe Odontoneminae. Bremekamp (1965) included Lindau's Odontonemeae in a much-expanded Justicieae. Recent phylogenetic analyses of Justicieae based on molecular markers (McDade et al. 2000) place *Streblacanthus* as sister to *Pachystachys* Nees in a clade ("Tetramerium Lineage") that includes genera from several of Lindau's tribes. In addition to their molecular synapomorphies, most genera in this lineage share the following traits: an androecium of two stamens (no staminodes), tricolporate-hexapseudocolpate pollen, and a basic chromosome number of 18. *Streblacanthus* is distinguishable from most other genera in this lineage by the combination of its corolla with an elongate, subcylindric tube and capsule with a flattened, subcircular head. *Ecbolium* Kurz, an Old World genus of 22 species (Vollersen 1989), and *Yeatesia* Small, a North American genus of three species (Hilsenbeck 1989), also share these characteristics. Studies addressing the generic distinctions among these three genera are much needed.

At least 36 genera of Acanthaceae are known to be native in Mexico (Daniel 1998). Two other genera may be native there; *Geissomeria* Lindl. and *Pachystachys* are reported from Mexico based on unresolved nineteenth century collections (Daniel 1998; Wasshausen 1986). The addition of another genus of Acanthaceae native to Mexico is not altogether surprising. *Staurogyne* Wall., an acanthaceous genus previously known from southern Central America and South America, was recently reported from the country for the first time (Daniel & Lott 1993). Furthermore, the herbaceous flora of various regions in Mexico remains inadequately known. This is particularly true for the rain forests in the vicinity of the Gulf coast of Mexico.

The Uxpanapa-Chimalapa region harbors a significant number of Acanthaceae common in, or restricted to, wet forests: e.g., *Aphelandra aurantiaca* Lindl., *A. wendtii*

T.F. Daniel, *Justicia aurea* Schltdl., *J. fimbriata* (Nees) V. A. W. Graham, *Louleridium mexicanum* (Baill.) Standl., *L. parayi* Miranda, *Mendoncia guatemalensis* Standl. & Steyerl., *Mirandea sylvatica* Acosta, *Pseuderanthemum verapazense* Donn. Sm., *Ruellia harveyana* Stapf, *R. jussieuoides* Schltdl. & Cham., *Schaueria parviflora* (Leonard) T. F. Daniel, and *Stenandrium chameranthemoideum* Oerst. At least three species of Acanthaceae are endemic to this region, *Justicia chimalapensis* T. F. Daniel, *J. wendtii* T. F. Daniel, and *Lophostachys uxpanapensis* Acosta. Based on known occurrences of taxa, the acanthaceous affinities of the Uxpanapa-Chimalapa region lie with the Los Tuxtlas region of Veracruz to the northwest and the lowlands of Tabasco and Chiapas to the east. Floristic affinities among the lowland rain forests in these areas, together with the Tuxtepec area of northern Oaxaca, were noted by Wendt (1993) for the rain forest canopy tree flora; each of these regions was also noted by Wendt to be of particular importance for conservation efforts. Further explorations in and collections from these areas will undoubtedly yield additional new taxa and significant geographic range extensions.

Streblacanthus Kuntze, Revis. gen. pl. 1: 497. 1891.—TYPE: *Streblacanthus monospermus* Kuntze.

Sciaphyllum Bremek., Recueil Trav. Bot. Néerl. 37: 298. 1940.—TYPE: *Sciaphyllum amoenum* Bremek. [= *Streblacanthus roseus* (Radlk.) B. L. Burtt].

Erect perennial herbs or shrubs with cystoliths. Leaves opposite, petiolate, margin entire to subcrenate. Inflorescence of axillary or terminal dichasiate spikes or racemes; dichasia opposite (to alternate), 1–many-flowered, sessile, subtended by a bract. Bracts opposite (to alternate), green, margin entire. Flowers homostylous, sessile to pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 4–5-lobed, lobes homomorphic (or subequal in length). Corolla pinkish to purplish or white, subsalverform or with a relatively long and slender tube and a bilabiate limb, tube elongate and subcylindric, sometimes expanded distally into a throat, limb subactinomorphic to bilabiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 2, inserted near apex of corolla tube, exerted from mouth of corolla, anthers 2-theous, thecae homomorphic or heteromorphic, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal), if homomorphic then thecae equal in size, parallel, and equally to subequally inserted, if heteromorphic then thecae unequal in size and superposed (the proximal theca abortive and greatly reduced); pollen spherical to prolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium (these sometimes fused near poles forming pseudocolpal ellipses), exine reticulate. Style exerted from mouth of corolla, stigma 2-lobed or appearing discoid to subcapitate, lobes sometimes indistinct. Capsule stipitate, head subcircular, retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 2–4, homomorphic, lenticular, lacking trichomes. Base chromosome number: $x = 18$.

Eleven names have been used in *Streblacanthus* but only four species are currently recognized in this wholly American genus (Daniel 1996). The relationships among these species have never been fully studied.

Streblacanthus monospermus Kuntze, Revis. gen. pl. 2: 498. 1891.—TYPE: COSTA RICA. [Without province:] “auf dem Höhenzug südlich von San Jose in Costarica” (fide protologue), “bei S. José” (fide specimen), Jun 1874, O. Kuntze s.n. (holotype: NY!).

Streblacanthus macrophyllus Lindau in H. Pittier, Prim. Fl. Costaric. 2: 306. 1900.—TYPE: COSTA RICA. Limón: “in silvis ad flumen Zhorquin [Yorkín] (Pitt. n. 8547), alt. 50 m.” (fide protologue), “forêts de la boca de Zhorquin (Talamanca)” (fide specimen at US), Mar 1894, *H. Pittier* 8547 (holotype: B, destroyed, photos: F! GH! US!; isotype: US!). The original label on the isotype at US, which was determined by Lindau, notes A. Tonduz as the collector. Photos of the holotype at B reveal that Pittier was noted as the collector on labels of that specimen.

Streblacanthus longiflorus Cufod., Arch. Bot. Sist. 10: 48. 1934.—TYPE: COSTA RICA. Limón: La Castilla–Los Negritos, 12 km from the mouth of the Río Reventazón, riverside forest, 30 m, 7 May 1930, *G. Cufodontis* 336 (holotype: W, photos: F! GH! US!).

Fig. 1

Herbs to 4 dm tall. Young stems subterete to subquadrate, bifariously pubescent with flexuose-retrorse eglandular trichomes 0.5–1.3 mm long. Leaves petiolate, petioles to 2.5 cm long, densely pubescent with antrorse eglandular trichomes adaxially and glabrous or nearly so abaxially, blades ovate to elliptic, 9.5–11.8 cm long, 3.4–4.1 cm wide, 2.7–3.0 times longer than wide, acuminate at apex, acute at base, surfaces pubescent along midvein (less densely so on abaxial surface) with antrorse eglandular trichomes, otherwise glabrous or nearly so, margin ciliolate with antrorse eglandular trichomes. Inflorescence of (axillary and) terminal pedunculate spikes to 4 cm long (including peduncle and excluding flowers), subtended by a pair of greatly reduced leaves from whose axils spikes sometimes arise, peduncles (from reduced leaves to first pair of bracts) to 14 mm long, evenly pubescent with erect to flexuose eglandular and glandular trichomes 0.2–1.6 mm long, rachis pubescent like peduncles; dichasia 1-flowered, opposite to subopposite, sessile; flowers sessile. Bracts opposite to subopposite, sessile, elliptic to obovate, 6.5–10 mm long, 2.3–2.6 mm wide, abaxial surface pubescent with erect to flexuose glandular trichomes 1–2.3 mm long. Bracteoles linear to lanceolate, 3.5–5 mm long, 0.5–0.9 mm wide, abaxial surface pubescent with mostly glandular trichomes 0.2–0.6 mm long. Calyx 4-lobed, 3.5 mm long, lobes lanceolate, 3 mm long, 0.6 mm wide, abaxially pubescent with antrorse to erect to flexuose glandular and eglandular trichomes 0.1–0.3 mm long. Corolla subsalverform, purplish, 3.6–3.7 cm long, externally pubescent with flexuose eglandular trichomes (0.3–) 0.7–1.5 mm long, tube subcylindric (becoming narrower distally), 2.6–2.8 cm long, 1–1.2 mm in diameter near midpoint, throat absent, upper lip 7.5–10 mm long, lobes 5.5–7 mm long, 3–4 mm wide, lower lip 8–10 mm long, lobes 7.5–9.5 mm long, 4–5 mm wide, lobes abruptly acuminate at apex (or with 2–3 apical teeth). Stamens 2–2.5 mm long, inserted near mouth of corolla, exserted 1.5–2 mm beyond mouth of corolla, filaments apically pubescent with flexuose eglandular trichomes to 0.5 mm long, thecae superposed (0.3–0.5 mm distant), distal theca fertile, 0.8–1 mm long, asymmetric when dehiscent, proximal theca sterile, appendage-like, 0.2 mm long; pollen prolate spheroidal to subprolate ($P:E = 1.14\text{--}1.25$). Style 1.9–2.3 cm long, glabrous, stigma discoid, 0.1 mm long. Capsule 1.5–1.7 cm long, pubescent with erect to flexuose eglandular trichomes 0.5–2.1 mm long, stipe 7–8.5 mm long, head 8–9 mm long. Seeds 4, flat, subcordate, 5 mm long, 5 mm wide, surfaces papillose, margin swollen, entire to subcrenate.

Phenology. Flowering and fruiting: March.

Distribution and habitat (Fig. 2). Known disjunctly from southern Mexico (Oaxaca) and from adjacent regions of Costa Rica (Limón) and Panama (Bocas

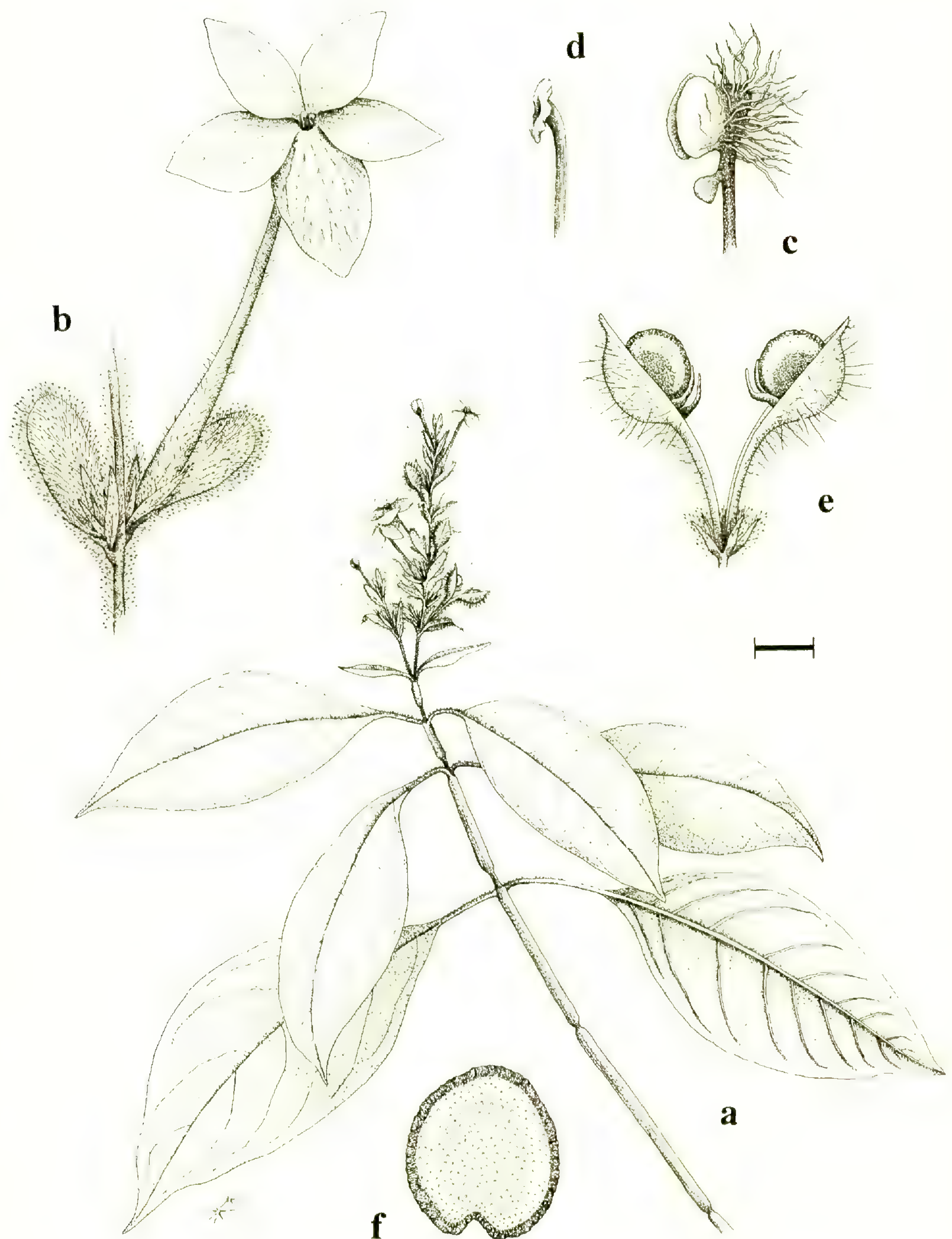


FIG. 1. *Streblacanthus monospermus*. a. Habit. b. Inflorescence node with flower. c. Apex of stamen with thecae. d. Apex of style with stigma. e. Capsule with seeds. f. Seed. Scale bar: a, 2.1 cm; b, 3 mm; c, 0.55 mm; d, 0.1 mm; e, 3.7 mm; f, 1.7 mm. (Based on: a–c, *Daniel et al.* 6230; e–f, *Hernández G.* 1060.)

del Toro); in Mexico, plants occur in a lowland rain forest with *Ficus*, *Dialium*, *Vatairea*, and *Manilkara* at an elevation of 250 m.

ADDITIONAL SPECIMEN EXAMINED. **Mexico.** OAXACA: Mpio. Sta. María Chimalapa, ca. 10 km O de Sta. María por la vereda a Chicosaja, 16°53'N, 94°46'W, 30 Mar 1985, *H. Hernández G.* 1060 (CAS).

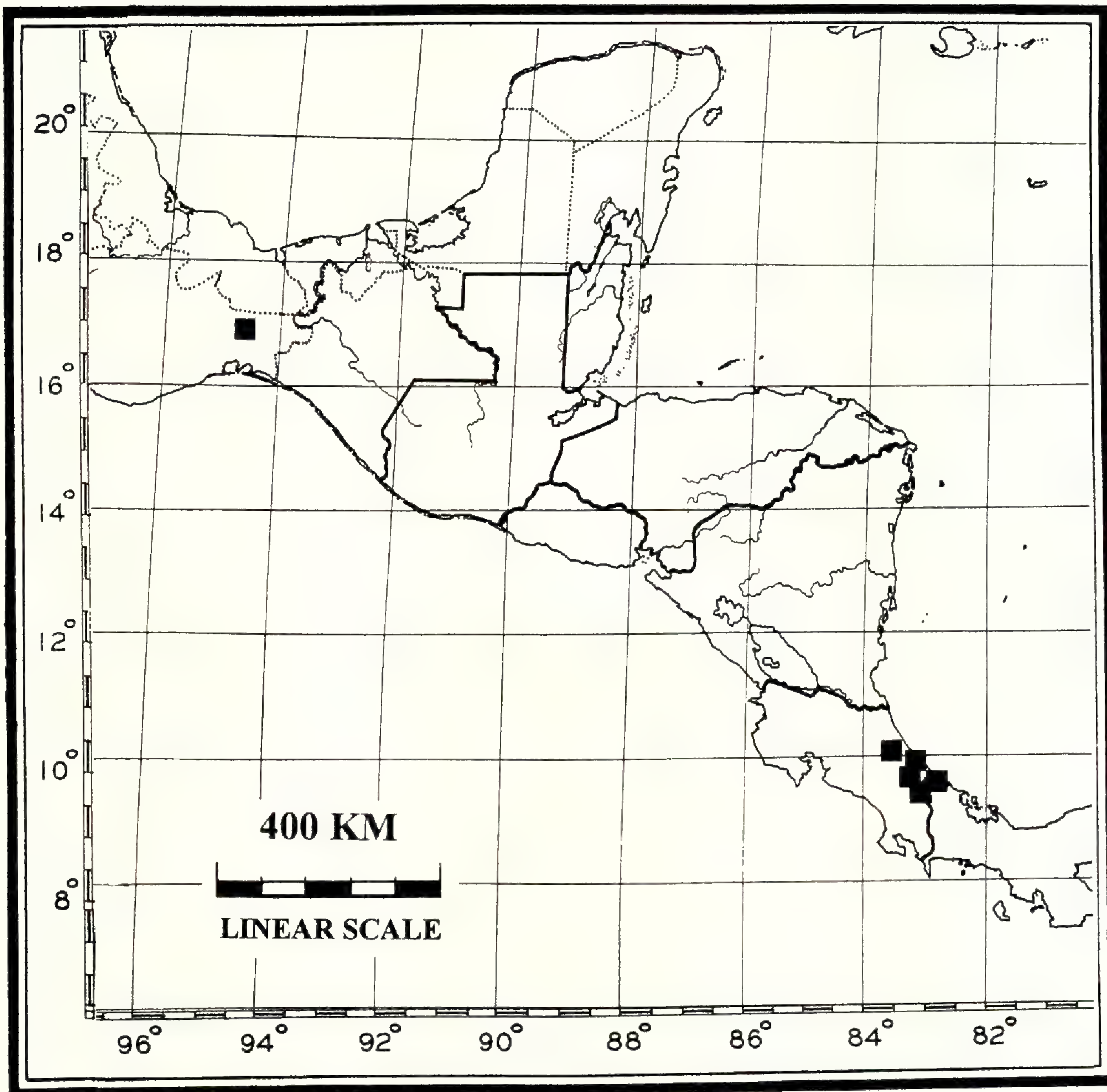


FIG. 2. Distribution of *Streblacanthus monospermus*.

Daniel (1996) noted that *Streblacanthus monospermus* was known from Costa Rica and Panama. Durkee (1986) indicated that the species occurs in lowland rain forests of the Caribbean coastal region. The only known Mexican collection resembles plants from southern Central America by sharing the following characteristics, which are otherwise unknown in the genus: dense adaxial petiolar pubescence, 4-lobed calyces, subsalverform corollas, apically pubescent filaments, one abortive theca per anther, and seeds with a marginal swelling. Mexican plants differ from those of southern Central America only by their shorter capsules (1.5–1.7 vs. 2.0–2.5 cm long).

Pollen of *Streblacanthus monospermus* (Fig. 3) resembles that of other Jus-ticieae in the “*Tetramerium* Lineage.” Pollen from the Mexican collection (Fig. 3a–b) differs from that of collections from southern Central America (Fig. 3c) by having distinct pseudocolpi in the mesocolpia and by being somewhat smaller in size (ca. 35–40 μm vs. 45–70 μm in polar diameter).

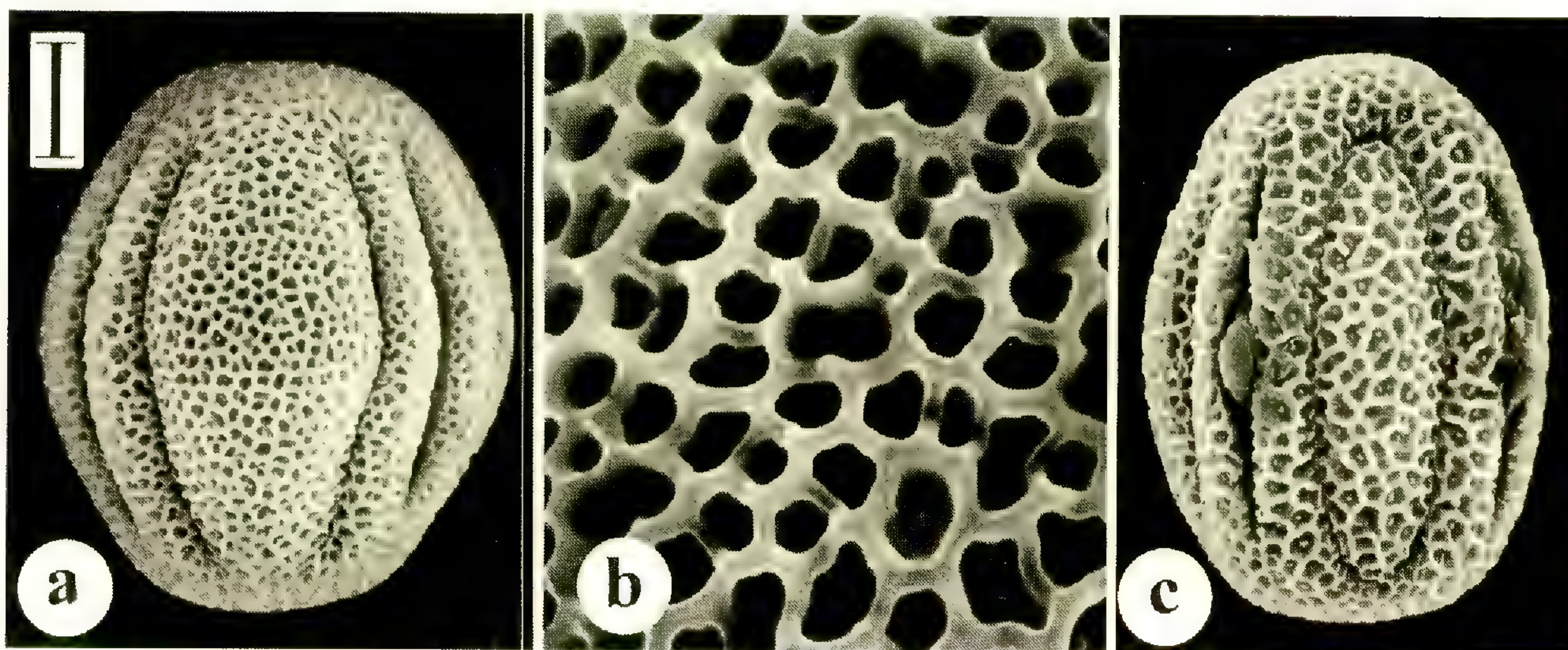


FIG. 3. Pollen of *Streblacanthus monospermus*. a. Hernández G. 1060 (intercolpal view). b. Hernández G. 1060 (detail of surface). c. Daniel et al. 6230 from Costa Rica (intercolpal view). Scale bar: a, 6.8 μm ; b, 1.5 μm ; c, 12.5 μm .

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CHECKLIST OF LICHENS AND ALLIED FUNGI OF MICHIGAN

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ABSTRACT. An annotated checklist of the taxa of lichen-forming, lichenicolous, and allied fungi collected from the state of Michigan is presented. It was compiled from specimens deposited in the herbaria of Michigan State University, the University of Michigan, and the University of Minnesota, and supplemented with additional records from the state's National Parks/Lakeshores and the literature. The checklist includes 784 taxa of lichenized fungi, comprising 774 species, 6 subspecies, and 4 varieties. Also included are 38 non-lichenized taxa, which are either lichenicolous fungi (11 species), or non-lichenized fungi (27 species) that resemble lichenized taxa, and are likely to be encountered by those studying lichens. Michigan has the richest lichen flora any of the Great Lakes States.

INTRODUCTION

The list presented below is the first checklist of the lichens of Michigan to be published. Previously, the most comprehensive coverage was provided by Harris's (1977) *Lichens of the Straits Counties, Michigan*, which focussed on the Mackinac Straits region, but included records of lichens found throughout the state along with identification keys to many genera. Harris was aware that many areas of Michigan were under-recorded, in particular, the rich saxicolous flora of the Upper Peninsula, and he recognized that his total of 610 taxa (of which ca. 50 were undescribed) was probably low, and that "the total for the state might be as high as 700" (Harris 1977, p. ii). In fact, even this has proved to be an underestimate; the current list includes nearly 800 taxa. The lichen flora of Michigan appears to be the most extensive of any of the Great Lakes States, and far exceeds the ca. 550 taxa recorded from Minnesota (Wetmore, unpubl.), 623 from Wisconsin (Thomson, in press), and 465 from Southern Ontario (Wong & Brodo 1992). In spite of the dramatic increase in the number of species recorded since 1977, Harris's statement concerning the under-recorded "rich saxicolous flora of the Upper Peninsula" remains true, and many additional species are to be expected.

Modern lichen collecting in Michigan began in 1949, when Henry A. Imshaug started his investigations of the lichen vegetation of the Great Lakes Area, which he pursued until his retirement in 1990. During this time over 25,000 specimens were collected by Imshaug and his students (including R. C. Harris, C. M. Wetmore, F. H. Erbsch, R. S. Common, and J. Malachowski) and deposited in the herbarium of Michigan State University (MSC). A lichen flora of the area was planned but never reached publication. The present list is based upon these extensive collections.

VEGETATION, GEOLOGY, AND CLIMATE

The state of Michigan covers an area of 150,220 km² (excluding the Great Lakes) and comprises two peninsulas, the Lower Peninsula between Lakes Huron

and Michigan, and the Upper Peninsula between Lakes Michigan and Superior. The Great Lakes area was completely covered with ice during the last (Pleistocene) glaciation, and when this ice retreated northwards, between 13,000 (southernmost Lower Peninsula) and 10,000 years ago (Upper Peninsula), it left behind a generally flat landscape with only low undulations. The Great Lakes themselves are 175–200 m above sea level, and the highest elevation in the state is 600 m in Baraga County in the western Upper Peninsula. The natural vegetation is deciduous forest (Oak-Hickory and Beech-Sugar Maple) in the south, giving way to Northern Hardwood and Pine forests around the center of the Lower Peninsula (ca. 44°N). Yet, little natural vegetation remains, especially in the Lower Peninsula, where woodland is mostly all secondary growth. There is more old-growth woodland in the Upper Peninsula, although nowhere is this abundant.

The vast deposits of glacial drift left behind by the retreating glaciers effectively buried the bedrock in the Lower Peninsula, as well as much of the eastern half of the Upper Peninsula. A band of limestone runs through the state near the Straits of Mackinac (between the Lower and Upper Peninsulas) that increases the diversity of the available substrata for lichens. Natural rock outcrops are more numerous in the western half of the Upper Peninsula, which also has much older Pre-Cambrian or Cambrian rock formations.

The climate of the state is generally continental (hot summers, cold winters, and moderate precipitation), although this is moderated to a significant extent by the influence of the Great Lakes. The annual mean temperature varies between 5 and 10°C and the annual mean precipitation from 700 to 900 mm.

The resulting lichen vegetation is northern temperate with a strong boreal influence in the north. The influence of the Great Lakes also increases the overall humidity of the climate, resulting in the occurrence in Michigan of species with a generally Appalachian distribution (e.g., *Anzia colpodes*). Some species with a generally southern/prairie distribution also occur in the southwest of the state (e.g., *Cladonia robbinsii*), with a major disjunction on Beaver Island in northern Lake Michigan (e.g., *Teloschistes chrysophthalmus*).

COMPILATION OF THE LIST

For each species from Michigan represented in MSC, label data (including annotations) from two voucher specimens were entered into a database, which was then used to generate the checklist. This was supplemented with data from three additional sources: 1) specimens held in the herbaria of the University of Minnesota (MIN) and the University of Michigan (MICH); 2) species lists for the three National Parks/Lakeshores in Michigan (Isle Royale, Pictured Rocks, and Sleeping Bear Dunes) published on the internet by Dr. C. M. Wetmore (<http://www.ies.wisc.edu/brd/lichen.htm>); 3) recent (post-1970) published literature records.

Collections from the University of Minnesota (MIN) or the University of Michigan (MICH) were included for taxa not represented in MSC. Unless otherwise cited, all collections are held in MSC. For collections lacking data the literature reference in which a taxon is recorded from Michigan is quoted.

Each entry has been annotated with the substratum upon which the taxon usually occurs. As an assessment of a taxon's distribution within Michigan, the number of counties in the Upper (UP) and Lower (LP) Peninsulas from which specimens exist in MSC, MICH, or MIN are noted. Literature records are not usually included, except where no herbarium specimen could be located. This is followed by collection and locality details from the two specimens of the taxon

from Michigan retrieved from the database, cited as "County: locality, substratum, date of collection, collector, (location of specimen)."

The description of the substratum upon which a species is likely to be found has been broadly defined deliberately, and has largely been compiled from published sources (e.g., Santesson 1993). Listing only the substratum of the few collections seen would give, in many cases, an unrealistically narrow impression of the range of substrata upon which the species occurs. The habitat/substratum preferences for a species within the state can, in most cases, be obtained from the data for the individual collections.

IDENTIFICATION

Anyone wishing to identify lichens in Michigan would be well advised to consult Harris (1977). Although now rather dated, especially with regard to nomenclature, this account is still by far the best and most comprehensive work available. Also worthy of mention is *Michigan Lichens* (Medlin 1996). It is an excellent introduction with good color photographs (some of which are available on the author's web-site: <http://www.nmc.edu/~medlinj/>), but includes only a small percentage of the species present in the state. Also of use are *Keys to the Lichens of Minnesota* (Wetmore, unpubl.), *The Lichens of Southern Ontario, Canada* (Wong & Brodo 1992), and *Lichens of Wisconsin* (Thomson, in press). These and other references to identifying North American lichens in general can be found on the internet at <http://herbaria.harvard.edu/Data/Farlow/lichenguide/index.html>.

NOTES CONCERNING THE CHECKLIST

An annotated checklist is presented below of all the taxa of lichen-forming, lichenicolous, and allied fungi known to have been collected from Michigan. The checklist includes 784 taxa of lichenized fungi, comprising 774 species, 6 subspecies, and 4 varieties. Also included are 38 non-lichenized taxa, which are either lichenicolous fungi (11 species), or non-lichenized fungi (27 species) that resemble lichenized taxa and are likely to be encountered by those studying lichens.

The present list is in no way definitive and must be considered preliminary. It is largely compiled from herbarium specimens, many of which were named 20–30 years ago and need confirmation. Although the great majority of the determinations were made by highly proficient lichenologists (Imshaug, Harris, Wetmore, etc.), taxonomic concepts have changed significantly in the intervening period; it is highly probable that critical re-examination of many of these specimens will result in their re-determination. Also, the rich lichen collections held at the herbarium of the University of Michigan Biological Station have not been included here, and it is probable that that collection will hold many new county, if not state, records.

The publication of this list is a necessary first stage towards a more up-to-date understanding of the extent, composition, and importance of lichen vegetation of Michigan. Work is already underway to produce distribution maps for the species included in the present list, and the preparation of a list of endangered lichen species in the state. We welcome comments, additions, and corrections.

Nomenclature follows the last published checklist of North American lichens (Esslinger & Egan 1995), which should be consulted for a full list of synonyms. We have occasionally used a more current name than that given by Esslinger and Egan, usually from the on-line version (Esslinger 1997), in which case we have given Esslinger's earlier name as a synonym.

THE CHECKLIST

Symbols and abbreviations: * = lichenicolous fungus, † = non-lichenized fungus; UP = Upper Peninsula, LP = Lower Peninsula; NL = National Lakeshore, NP = National Park, SP = State Park.

***Abrothallus parmeliarum** (L.) Ach. - on parmelioid lichens; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, hill behind Siskiwi Bay CCC camp, on *Melanelia olivacea*, June 1958, *Wetmore 1730*.

Absconditella lignicola Vezda & Pisút [all collections seen were misidentified as *A. trivialis*] - on lignum, mossy bark; UP: 0, LP: 3.

Iosco: W of Oscoda, between River Rd and AuSable River, *Thuja* swamp, May 1971, *Common 2454D*.—Otsego: between Pigeon River and Valley Rd, *Populus* with *Betula* and *Prunus*, May 1977, *Common, RS 4134D*.

Acarospora americana H. Magn. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Ojibway, NE of tower, July 1980, *Wetmore 41462* (MIN); Isle Royale NP, Hawk Island, July 1984, *Wetmore 53245* (MIN).

Acarospora badiofusca (Nyl.) Th. Fr. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, along shores and rocky cliffs, June 1958, *Wetmore 2585B*.

Acarospora canadensis H. Magn. - saxicolous, on siliceous or weakly calcareous rocks; UP: 1, LP: 0.

Chippewa: Drummond Island, open *Pinus resinosa* and *Picea* woodland adjacent to old field and limestone pavement, Oct 1976, *Imshaug 60101A*.

Acarospora fuscata (Schrader) Arnold - saxicolous, on siliceous rocks; UP: 10, LP: 13.

Baraga: ca. 0.5 mi N of Sturgeon River Campground, 5 mi NE of Sidnaw, *Populus* woods, Sept 1972, *Harris 8150A*.—Chippewa: Drummond Island, E side of Big Shoal Cove, scattered *Thuja* with exposed limestone pavement and low *Juniperus*, Oct 1976, *Imshaug 9942*.

Acarospora glaucocarpa (Ach.) Körber - saxicolous, on calcareous rocks; UP: 4, LP: 2.

Chippewa: Drummond Island, E side of Big Shoal Cove, exposed limestone pavement and low *Juniperus* with scattered *Thuja*, Oct 1976, *Imshaug 59979*.—Mackinac: exposed boulders, along railroad N of Moran, on limestone boulders, Sept 1996, *Harris 1068*.

Acarospora immersa Fink - saxicolous, on calcareous rocks; UP: 2, LP: 6.

Clinton: Rose Lake Game Area, field SE of junction of Clark and Peacock Rds, Apr 1969, *Harris 4002*.—Oscoda: between Watson Rd and Union Corners Rd, ca. 7 mi S of Mio, *Pinus banksiana* woods, Sept 1973, *Harris 8390*.

Acarospora macrospora (Hepp) Bagl. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Mackinac: on calcareous pebbles (Harris 1977).

Acarospora oligospora (Nyl.) Arnold - saxicolous, on weakly basic rocks; UP: 0, LP: 3.

Oscoda: near Wagner Lake, ca. 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, Sept 1973, *Harris 8200*.

Acarospora smaragdula (Wahlenb.) A. Massal. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Acrocordia cavata (Ach.) R. C. Harris - corticolous, on deciduous trees; UP: 5, LP: 4.

Delta: NW of Isabella, swamp on USFS 2231, 1.8 mi W of USFS 2226, on *Fraxinus*, Sept 1969, Harris 4256.—Lake: Irons, Bear Track U.S. Forest Campground, *Thuja* swamp, on *Populus*, Sept 1968, Harris 3877.

Acrocordia conoidea (Fr.) Körber - saxicolous, on calcareous rocks; UP: 1, LP: 2.

Mackinac: on limestone (Harris 1977).

Acrocordia gemmata (Ach.) A. Massal. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Acrocordia megalospora (Fink) R. C. Harris - corticolous, on deciduous trees; UP: 0, LP: 2.

Kalamazoo: Kellogg Forest, on *Quercus alba*, June 1965, Harris 141.—Washtenaw: *Quercus-Carya* woods NW of Crooked Lake, on *Quercus alba*, Sept 1965, Harris 870A.

Ahtiana aurescens (Tuck.) Thell & Randlane - corticolous, on coniferous trees; UP: 2, LP: 0.

Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, Harris 7537.—Keweenaw: S of Copper Harbor, Wilderness Rd (Mandam Rd), swamp with dead *Thuja* trees and *Typha*, July 1976, Imshaug 58895.

Allocetraria oakesiana (Tuck.) Randlane & Thell - on old wood; UP: 0, LP: 2.

Cheboygan: S side of Hebron Mail Rd, 1 mi N of Levering Rd, *Thuja* swamp, base of *Abies*, June 1973, Wang 254.—Newaygo: S of Four-Mile Rd, 6 mi NE of White Cloud, old *Thuja* swamp, on fallen conifer, Sept 1973, Wang 322.

Amandinea dakotensis (H. Magn.) P. May & Sheard - corticolous, on coniferous and deciduous trees; UP: 0, LP: 2.

Cheboygan: 6 mi N of Wolverine, off Blueberry Rd, on *Populus grandidentata*, Oct 1974, Wang 1205.—Mason: 9 mi S of Manistee, 0.5 mi from Lake Michigan, on *Populus tremuloides*, Aug 1974, Wang 852.

Amandinea milliaria (Tuck.) P. May & Sheard (syn. *Rinodina milliaria*) - corticolous, on coniferous and deciduous trees; UP: 1, LP: 1.

Keweenaw: Keweenaw Point, West Mt, July 1947, Thomson 3296 (MIN).—Mason: Lake Michigan, Big Sable Point near Ludington, forested dunes between Lake Michigan and Hamlin Lake, on *Quercus*, June 1957, Imshaug 19710.

Amandinea punctata (Hoffm.) Coppins & Scheid. - corticolous; UP: 7, LP: 18.

Baraga: along Sturgeon River upstream from bridge, 5 mi NE of Sidnaw, wet woods, on *Tilia*, Sept 1972, Harris 8060.—Oscoda: along E branch of Big Creek downstream from Mapes Rd (County Rd 487), *Thuja-Picea* swamp, on dead *Picea*, Sept 1973, Harris 8295C.

Amygdalaria panaeola (Ach.) Hertel & Brodo - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, Wetmore 49544 (MIN).

Anaptychia palmulata (Michaux) Vainio - saxicolous and corticolous; UP: 8, LP: 4.

Alger: Pictured Rocks NL, E side of Grand Portal Point, on *Betula alleghaniensis*, July 1987, *Wetmore 59795* (MIN).—Keweenaw: Isle Royale NP, 0.5 mi E of Windigo, on *Thuja*, July 1984, *Wetmore 51879* (MIN).

Anaptychia setifera Räsänen - saxicolous and corticolous, on deciduous trees; UP: 5, LP: 5.

Delta: S end of Summer Island, shore of lake, on limestone boulder, July 1968, *Miller 4750*.—Keweenaw: Isle Royale NP, Davidson Island, trees and rocks, Aug 1972, *Tucker 10633*.

Anisomeridium biforme (Borrer) R. C. Harris - corticolous, on deciduous trees; UP: 1, LP: 4.

Washtenaw: Crooked Lake, in *Quercus-Carya* woods NW of Crooked Lake, on *Quercus alba*, Sept 1965, *Harris 869*.

Anisomeridium carinthiacum (Steiner) R. C. Harris - saxicolous, on inundated, calcareous rocks; UP: 1, LP: 0.

Delta: Haymeadow Creek Falls Nature Trail, County Rd 509 NE of Rapid River, on shale at edge of stream, Sept 1969, *Harris 4210B*.

Anisomeridium leucochlorum (Müll. Arg.) R. C. Harris - corticolous, on deciduous trees; UP: 0, LP: 1.

Washtenaw: SE of South Lake, on *Fraxinus*, Feb 1975, *Harris 9797* (MIN).

Anisomeridium polypori (Ellis & Everh.) M. E. Barr (syn. *A. nyssaegenum*) - corticolous; UP: 6, LP: 22.

Clinton: Maple River, *Thuja* swamp E of Hinman Rd, S of unnamed tributary of Maple River, on *Thuja*, Nov 1973, *Harris 8490*.—Ingham: MSU campus, Baker Woodlot, N of SE pond, on *Fraxinus*, Nov 1973, *Harris 8509*.

Anzia colpodes (Ach.) Stizenb. - corticolous, on deciduous trees; UP: 2, LP: 0.

Luce: Upper Tahquamenon Falls, ca. 1.2 mi W. of Paradise on Mich Hwy 123, on recently downed *Acer saccharum*, July 1979, *Parrella s.n.*.

Arctoparmelia centrifuga (L.) Hale - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, outside of Locke Point, July 1983, *Wetmore 47421* (MIN).

Arctoparmelia subcentrifuga (Oksner) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore 47265* (MIN).

Arthonia byssacea (Weigel) Almq. - corticolous, on deciduous trees; UP: 1, LP: 1.

Cheboygan: Gorge of Carp Creek, on base of *Betula alleghaniensis*, July 1974, *Harris 8900*.—Keweenaw: Estivant Pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Acer* and *Betula*, July 1976, *Imshaug 59126*.

Arthonia caesia (Flotow) Körber - corticolous, on deciduous trees; UP: 6, LP: 44.

Gladwin: swampy area near Estey, on *Populus*, May 1958, *Imshaug 21615*.—Houghton: near Baltic along wet ravine with *Acer* on sides and *Picea-Abies balsamea* in center, on *Acer saccharum*, June 1958, *Wetmore 1432*.

Arthonia cytisi A. Massal. - corticolous; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Arthonia didyma Körber - corticolous, usually on deciduous trees; UP: 8, LP: 2.

Cheboygan: along Carp Creek at Hogsback Rd, *Thuja* swamp, on *Thuja*, July 1974, *Harris* 8945.—Keweenaw: 2 mi E of Fort Wilkins, mixed hardwood-conifer forest, on *Acer*, July 1976, *Imshaug* 59039.

Arthonia diffusa Nyl. - corticolous UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Arthonia diffusella Fink - corticolous, on coniferous and deciduous trees; UP: 5, LP: 0.

Alger: Pictured Rocks NL, W of Beaver Island, at Lake Superior, on *Betula alleghaniensis*, July 1987, *Wetmore* 59407 (MIN).

Arthonia dispersa (Schrader) Nyl. - corticolous, on deciduous trees; UP: 2, LP: 1.

Berrien: Warren Dunes SP, picnic area, on *Tilia americana*, June 1985, *Wetmore* 53814 (MIN).—Keweenaw: Isle Royale NP, Ishpeming Point, on *Sorbus americana*, July 1983, *Wetmore* 48935 (MIN).

Arthonia fuliginosa (Schaerer) Flotow - corticolous, usually on deciduous trees; UP: 2, LP: 1.

Keweenaw: Isle Royale NP, bay N of Stockly Bay, on *Thuja*, July 1983, *Wetmore* 49819 (MIN).—Leelanau: Sleeping Bear Dunes NL, Glen Arbor, S of cemetery, on *Acer saccharum*, July 1987, *Wetmore* 58296B (MIN).

***Arthonia intexta** Almq. - lichenicolous, in apothecia of *Lecidiella* spp.; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, outside of Locke Point, July 1983, *Wetmore* 47407 (MIN).

Arthonia lapidicola (Taylor) Branth & Rostrup - calcareous rocks; UP: 1, LP: 0.

Chippewa: on limestone (Harris 1977).

Arthonia patellulata Nyl. - corticolous, on deciduous trees; UP: 7, LP: 7.

Chippewa: Drummond Island, *Thuja* forest E of Bruce Point, on *Populus*, Oct 1976, *Common* 3995.—Montmorency: 4 mi S of Atlanta, off County Rd 487, on *Populus tremuloides*, Aug 1974, *Wang* 923.

Arthonia punctiformis Ach. - corticolous, on deciduous trees; UP: 3, LP: 0.

Houghton: upland area along shore of Lake Superior, June 1958, *Wetmore* 1357.

Arthonia radiata (Pers.) Ach. - corticolous, on deciduous trees; UP: 8, LP: 13.

Houghton: along shore of Lake Superior, on *Acer saccharum*, June 1958, *Wetmore* 1338A.—Mason: Big Sable Point, Ludington, on *Quercus*, June 1957, *Imshaug* 19718.

Arthonia spadicea Leighton - corticolous or lignicolous, on deciduous trees; UP: 1, LP: 0.

Chippewa: woods around Dick State Forest Campground, NE of Trout Lake, on lignum, Sept 1966, *Harris* 1029.

Arthonia willeyi Tuck. - corticolous, on deciduous trees; UP: 0, LP: 1.

Midland: 6.5 mi S of Coleman, on *Populus tremuloides*, Sept 1974, *Wang 1010*.

Arthothelium hallii (Tuck.) Zahlbr. - corticolous; UP: 0, LP: 2.

Clare: near Clare, *Thuja* bog, Apr 1958, *Imshaug 21041*.—Tuscola: near Caro, on *Tilia americana*, May 1958, *Imshaug 21489*.

Arthothelium ruanum (A. Massal.) Körber - corticolous, on deciduous trees; UP: 0, LP: 1.

Central Lower Peninsula (Harris 1977).

Arthothelium spectabile A. Massal. - corticolous, on deciduous trees; UP: 0, LP: 10.

Cheboygan: The Gorge, on *Acer*, July 1949, *Imshaug 3133*.—Newaygo: ENE of White Cloud, Dudgeon Swamp, S of One-Mile Rd, on *Fraxinus*, Oct 1972, *Harris 8161*.

Arthrorhaphis citrinella (Ach.) Poelt - saxicolous, in crevices in siliceous rocks; UP: 1, LP: 0.

Alger: Pictured Rocks NL, 1 mi NE of Twelve-Mile Beach Campground, July 1987, *Wetmore 5903* (MIN).

Arthrosporum populorum A. Massal. - corticolous, on deciduous trees; UP: 1, LP: 5.

Baraga: Yankee Springs Recreation Area, old fish hatchery, on *Populus*, July 1965, *Harris 406A*.—Osceola: near Wagner Lake, ca. 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, on *Populus tremuloides*, Sept 1973, *Harris 8249*.

Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold - saxicolous, on siliceous rocks; UP: 2, LP: 2.

Keweenaw: Isle Royale NP. Todd Harbor, Wilson Point, July 1983, *Wetmore 48113* (MIN); Isle Royale NP, Edwards Island. July 1983, *Wetmore 48483* (MIN).

Aspicilia cinerea (L.) Körber - saxicolous, on siliceous rocks; UP: 12, LP: 6.

Baraga: 5 mi NE of Sidnaw, 0.5 mi N of Sturgeon River Campground, *Populus* woods, Sept 1972, *Harris 8156*.—Dickinson: rocks near Schwartz Creek Dam, N of Ralph, on rocks, Sept 1971, *Harris 7628*.

Aspicilia contorta (Hoffm.) Kremp. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore 21359* (MIN); Isle Royale NP, West Caribou Island, July 1983, *Wetmore 46691* (MIN).

Aspicilia gibbosa (Ach.) Körber - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Aspicilia laevata (Ach.) Arnold - saxicolous, on semi-inundated, siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Aspicilia limitata (H. Magn.) J. W. Thomson - saxicolous, on pebbles; UP: 1, LP: 0.

Keweenaw: E of Hebard Park, on pebbles, Sept 1980, *Thomson 21290* (MIN).

Aspicilia supertegens Arnold - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: on shoreline ca. 6.5 mi W of Copper Harbor, on rocks ca. 13 m from the lake, Aug 1980, *Reschke 1203* (MICH).

Bacidia bagliettoana (A. Massal. & De Not.) Jatta - terricolous, on calcareous soils and plant debris; UP: 4, LP: 2.

Mackinac: E of Cedarville, on bank in *Populus* woods, Aug 1949, *Imshaug 3720*.—Presque Isle: Lake Huron, dune area at Presque Isle Point, June 1958, *Imshaug 22161*.

Bacidia circumspecta (Nyl. ex Vainio) Malme - corticolous; UP: 2, LP: 6.

Cheboygan: Reese's Bog, at bridge over Carp Creek on Hogsback Rd, on *Thuja*, July 1967, *Harris 3646*.

Bacidia diffracta S. Ekman - corticolous, on deciduous and coniferous trees; UP: 0, LP: 2.

Cheboygan, Emmet (Ekman 1996).

Bacidia laurocerasi (Delise ex Duby) Zahlbr. - corticolous, on deciduous trees; UP: 5, LP: 6.

Charlevoix: Beaver Island, bluff near Barney Lake, Aug 1961, *Imshaug 27745*.—Clare: 2 mi N of Long Lake, Townline Creek swamp, June 1973, *Harris 8175*.

Bacidia polychroa (Th. Fr.) Körber - corticolous, on deciduous trees; UP: 9, LP: 7.

Baraga: 5 mi NE of Sidnaw, swamp NE of Sturgeon River Campground, on *Fraxinus*, Sept 1972, *Harris 7865*.—Cheboygan: Univ. of Mich. Biological Station, moist hardwoods in gorge of Carp Creek, on *Fraxinus*, July 1967, *Harris 3663*.

Bacidia rosella (Pers.) De Not. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S Side Of Tonkin Bay, on *Populus tremuloides*, Jul 1980, *Wetmore 41319B* (MIN); Isle Royale NP, N Of Tallman Island, on *Populus tremuloides*, Jul 1983, *Wetmore 49341* (MIN).

Bacidia rubella (Hoffm.) A. Massal. - corticolous, on deciduous trees; UP: 7, LP: 9.

Cheboygan: Pine Grove State Forest, 0.75 mi NE of Pine Grove State Forest Campground, *Fagus-Acer* woods, on *Fraxinus*, Oct 1964, *Harris s.n.*.—Emmet: E of Hwy 31, 0.7 mi S of Levering, *Thuja* swamp, on *Ulmus*, June 1967, *Harris 3672*.

Bacidia schweinitzii (Fr. ex E. Michener) A. Schneider - corticolous, on deciduous and coniferous trees; UP: 12, LP: 16.

Crawford: Hartwick Pines State Park, on *Quercus alba*, May 1958, *Imshaug 21390*.—Presque Isle: near Presque Isle Lighthouse, on *Thuja*, June 1958, *Imshaug 22139*.

Bacidia subincompta (Nyl.) Arnold - corticolous; UP: 3, LP: 1.

Keweenaw: Isle Royale NP, head of Duncan Bay, on *Thuja*, July 1983, *Wetmore 47321* (MIN); Isle Royale NP, Brady Cove, on *Thuja*, July 1983, *Wetmore 47929* (MIN).

Bacidia suffusa (Fr.) A. Schneider - corticolous, on deciduous trees; UP: 4, LP: 5.

Dickinson: S of McGregor Creek, NNW of Ralph, *Acer* woods, on *Acer saccharum*, Sept 1971, *Harris 7606*.—Lake: Bear Track US Forest Campground, W of Irons, *Thuja* swamp, on *Fraxinus*, Sept 1968, *Harris 3891*.

Bacidia trachona (Ach.) Lettau - saxicolous, on calcareous rocks; UP: 0, LP: 1.

Alpena (Harris 1977).

Bacidina inundata (Fr.) Vezda - saxicolous, on semi-inundated rocks; UP: 2, LP: 0.

Chippewa: 4 mi E of Houghts Landing, Sept 1966, *Harris 1118B* (MIN).—Keweenaw: Keweenaw Point, S of Copper Harbor, July 1974, *Thomson 2979* (MIN).

Baeomyces rufus (Hudson) Rebent. - terricolous and saxicolous, on siliceous rocks; UP: 5, LP: 0.

Alger: at Laughing Whitefish Point, boggy area, Oct 1976, *Malachowski 3233*.—Marquette: Huron Mountains, Mt Ida, W side of Lake Ann, *Tsuga*, *Acer*, *Betula*, and *Pinus*, Oct 1976, *Malachowski 4185*.

Bellemerea cinereofuscens (Ach.) Clauzade & Roux - saxicolous, on siliceous rocks; UP: 2, LP: 2.

Alger: NE of Kingston Lake, open fields, Sept 1972, *Harris 6016*.

Biatora albohyalina (Nyl.) Bagl. & Carestia - corticolous, on deciduous trees; UP: 4, LP: 4.

Baraga: swamp E of Sturgeon River Campground, 5 mi NE of Sidnaw, on *Fraxinus*, Sept 1972, *Harris 7976-1*.—Clare: Townline Creek swamp, about 2 mi N of Long Lake, on *Fraxinus*, Oct 1971, *Harris 7669*.

Biatora anthracophila (Nyl.) Hafellner - corticolous, on burnt coniferous wood; UP: 7, LP: 8.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, July 1977, *Malachowski 6375B*.—Keweenaw: Isle Royale NP, forest along W bank of Siskiwit Creek from Siskiwit Lake to Lake Superior, in *Abies*, *Picea*, *Betula* and *Thuja* forest, on *Pinus* stump, June 1977, *Malachowski 5742A*.

Biatora botryosa Fr. - lignicolous or corticolous, on burnt wood; UP: 1, LP: 1.

Delta: Isabella, Camp 7 Lake NW of Isabella, on stump, Sept 1969, *Harris 4067*.

Biatora carneoalbida (Müll. Arg.) Coppins - muscicolous, on rocks and trees; UP: 1, LP: 1.

Cheboygan: 7 mi W of Cheboygan, on *Thuja*, Aug 1977, *Wetmore 29790* (MIN).—Keweenaw: High Rock Bay, Oct 1976, *Erbisch 4491* (MIN).

Biatora chrysantha (Zahlbr.) Printzen in V. Wirth - corticolous; UP: 2, LP: 0.

Alger: Pictured Rocks NL, S of Miners Falls, on *Thuja*, July 1987, *Wetmore 59577* (MIN).—Keweenaw: Isle Royale NP, Mt Franklin, June 1984, *Wetmore 51343* (MIN).

Biatora efflorescens (Hedl.) Räsänen - corticolous; UP: 3, LP: 1.

Keweenaw: Isle Royale NP, S of Brady Cove, July 1983, *Wetmore 48288* (MIN).—Mackinac: NNW of Big Knob, on *Thuja*, May 1977, *Harris 12273* (MIN).

Biatora epixanthoides (Müll. Arg.) Diederich - corticolous; UP: 5, LP: 1.

Cheboygan: S of Hebron Mail Rd, 2 mi N of Levering Rd, base of *Thuja* (swamp), June 1973, *Wang 281*.—Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, Sept 1971, *Harris 7507*.

Biatora helvola (Körber) Hellbom - corticolous, on deciduous and coniferous trees; UP: 4, LP: 2.

Alger: Pictured Rocks NL, 1 mi NE of Twelve-Mile Beach Campground, on *Populus grandidentata*, July 1987, *Wetmore 58999* (MIN).—Keweenaw: Isle Royale NP, NE of Thompson Island, on *Thuja*, July 1984, *Wetmore 51596* (MIN).

Biatora sphaeroides (Dickson) Körber - muscicolous on rocks and trees; UP: 9, LP: 6.

Marquette: Huron Mountains, Fortress, NE of Mountain Lake, on *Quercus*, Sept 1949, *Imshaug 5306*.—Presque Isle: *Thuja* swamp near Clinton Lake, on *Thuja*, July 1967, *Harris 3697*.

Biatora turgidula (Fr.) Nyl. - corticolous; UP: 2, LP: 1.

Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, *Harris 7508*.—Oscoda: Mio, woods E of Wagner Lake, ca. 7 mi S of Mio, *Pinus banksiana* woods, on stump, Sept 1973, *Harris 8330*.

Biatora vernalis (L.) Fr. - corticolous and terricolous (over bryophytes); UP: 6, LP: 1.

Alger: S end of Kingston Lake, moist woods, base of *Acer rubrum*, Sept 1970, *Harris 6024*.—Cheboygan: 6 mi N of Wolverine, off Blueberry Rd, on *Populus grandidentata*, Oct 1974, *Wang 1197*.

***Biatoropsis usnearum** Räsänen - lichenicolous on *Usnea* spp. on *Betula*; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, on *Usnea* sp., Aug 1972, *Wetmore 21117B* (MIN).

Bryoria capillaris (Ach.) Brodo & D. Hawksw. - corticolous, on coniferous trees; UP: 3, LP: 0.

Keweenaw: Isle Royal NP, on W side of McCargo Cove, 3 km from the cove mouth, in *Abies*, *Populus*, *Betula* forest, on *Picea*, June 1977, *Malachowski 6273*; Bete Grise Bay, 350 m N of Mendota Canal, along shore of Lake Superior, *Abies*, *Betula*, and *Acer* woods, Oct 1976, *Malachowski 5029B*.

Bryoria chalybeiformis (L.) Brodo & D. Hawksw. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, Aug 1972, *Wetmore 21118* (MIN); Isle Royale NP, Saginaw Point, on rock, July 1980, *Wetmore 41364* (MIN).

Bryoria furcellata (Fr.) Brodo & D. Hawksw. - corticolous, on coniferous trees; UP: 15, LP: 22.

Baraga: Huron River, 3 km WSW of mouth of Huron River, in *Abies*, *Betula*, *Pinus* forest, on *Pinus alba*, July 1977, *Malachowski 6415*.—Keweenaw: Isle Royal NP, on island in Lane Cove, with *Picea*, *Betula*, *Abies*, and *Larix*, on *Abies*, June 1977, *Malachowski 6096*.

Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw. - corticolous and lignicolous; UP: 4, LP: 1.

Cheboygan: Reese's Bog, N shore of Burt Lake, on *Abies*, July 1949, *Imshaug 2959A*.—Keweenaw: NE end of Schlatter Lake, in *Acer*, *Betula*, and *Pinus* woods, on *Quercus alba*, Oct 1976, *Malachowski 4526*.

Bryoria implexa (Hoffm.) Brodo & D. Hawksw. - corticolous, on coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Moskey Basin, at end of Rock Harbor near trail to Lake Richie, on *Abies alba*, July 1957, *Wetmore 424*.

Bryoria trichodes (Michaux) Brodo & D. Hawksw. subsp. **trichodes** - corticolous, on coniferous trees; UP: 12, LP: 2.

Cheboygan: W side of Hebron Mail Rd, 1 mi N of Levering Rd, *Thuja* swamp, June 1973, Wang 233.—Keweenaw: Isle Royale NP, 100 m W of Hay Bay Campground, in *Betula-Abies* forest, on *Abies*, June 1977, Malachowski 5847.

Bryoria trichodes subsp. **americana** (Mot.) Brodo & D. Hawksw. - corticolous, on coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Bryophagus gloeocapsa Nitschke ex Arnold - terricolous, over bryophytes; UP: 0, LP: 1.

Cheboygan (Harris 1977; Esslinger 1997).

Buellia arnoldii Servít & Nádv. - corticolous, on coniferous trees; UP: 5, LP: 1.

Keweenaw: Isle Royale NP, Mine Point, on *Pinus banksiana*, July 1983, Wetmore 49389 (MIN).—Leelanau: Sleeping Bear Dunes NL, Good Harbor Bay, Shalda Creek, on *Pinus banksiana*, July 1987, Wetmore 58596 (MIN).

Buellia dialyta (Nyl.) Tuck. - corticolous, on coniferous trees; UP: 0, LP: 1.

Cheboygan: Gorge of Carp Creek, on *Tsuga*, July 1974, Harris 8914.

Buellia disciformis (Fr.) Mudd - corticolous, usually on deciduous trees; UP: 13, LP: 5.

Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, on *Acer*, July 1976, Imshaug 59014.—Marquette: near edge of Pine Lake, 500 m W of Huron Mountain Club headquarters, on *Pinus*, Oct 1976, Malachowski 3777.

Buellia lauricassiae (Fée) Müll. Arg. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Buellia polyspora (Willey) Vainio - corticolous, on coniferous and deciduous trees; UP: 1, LP: 13.

Clare: 2 mi N of Long Lake, between new US Hwy 27 and old US 27, *Ulmus-Fraxinus-Thuja* swamp, on *Abies*, May 1970, Harris 5909.—Iosco: swampy area along the AuSable River, NW of Tawas City, on *Acer*, May 1969, Ohlsson 210A.

Buellia schaereri De Not. - corticolous, on coniferous trees; UP: 4, LP: 5.

Emmet: Wilderness State Park, W of Mackinac City, on dead conifer, Sept 1965, Harris 813.—Oscoda: E of Wagner Lake, ca. 7 mi S of Mio, *Pinus banksiana* woods, on cone of *Pinus banksiana*, Sept 1973, Harris 8338B.

Buellia spuria (Schaerer) Anzi - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Buellia stillingiana J. Steiner - corticolous, on coniferous and deciduous trees; UP: 15, LP: 21.

Keweenaw: 350 m N of Mendota Canal, Bete Grise Bay, along shore of Lake Superior, *Abies*, *Betula*, and *Acer* woods, on *Acer*, Oct 1976, Malachowski 5074.—Ontonagon: NE of Buckshot Cabin along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Abies*, Oct 1976, Malachowski 5574.

Buellia turgescens Tuck. - saxicolous, on siliceous rocks; UP: 1, LP: 1.

Jackson: Rodgers Reserve, on siliceous boulder, Aug 1999, *Fryday* 8001.—Keweenaw: Isle Royale NP, Tobin Harbor, Hidden Lake, July 1983, *Wetmore* 49206 (MIN).

Calicium abietinum Pers. - corticolous, on old wood; UP: 5, LP: 1.

Delta: N of Bill's Creek, NE of Rapid River, dry woods, on *Pinus* stump, Sept 1969, *Harris* 4158A.

Calicium glaucellum Ach. - corticolous, on old wood; UP: 1, LP: 2.

Keweenaw: Isle Royale NP (Wetmore 1997).

Calicium lenticulare Ach. - lignicolous; UP: 0, LP: 2.

Cheboygan: W of Hebron Mail Rd, *Thuja-Picea* swamp, on dead conifer, Aug 1974, *Harris* 9377.

Calicium parvum Tibell - corticolous, on coniferous trees; UP: 1, LP: 2.

Presque Isle: Evergreen Beach, *Thuja* swamp, on *Pinus resinosa*, July 1974, *Harris* 9022.

Calicium salicinum Pers. - corticolous, on coniferous trees and lignum; UP: 5, LP: 0.

Keweenaw: Isle Royale NP, SE of Grace Creek Bog, on conifer snag, July 1984, *Wetmore* 52091 (MIN); Isle Royale NP, 1 mi S of Huginnin Cove, on *Thuja* snag, July 1984, *Wetmore* 52805 (MIN).

Calicium trabinellum (Ach.) Ach. - corticolous, on old wood; UP: 6, LP: 2.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on dead conifer, Sept 1972, *Harris* 8098.—Cheboygan: along Carp Creek at Hogsback Rd, *Thuja* swamp, on stump, July 1974, *Harris* 8964.

Caloplaca arenaria (Pers.) Müll. Arg. - saxicolous, on siliceous rocks; UP: 3, LP: 1.

Ionian: rock pile in field near Saranac, on rock, Apr 1958, *Imshaug* 21116.—Iron: Kenton, old slate mine, Sept 1957, *Imshaug* 20765.

Caloplaca atroalba (Tuck.) Zahlbr. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Long Island, July 1959, *Wetmore* 5057; Isle Royale NP, Long Island, July 1959, *Wetmore* 5077.

Caloplaca cerina (Ehrh. ex Hedwig) Th. Fr. - corticolous, usually on deciduous trees, and terricolous on plant debris; UP: 13, LP: 29.

Marquette: Huron Mountains, hilltop on W side of Huron Mountains, on *Populus grandidentata*, Sept 1949, *Imshaug* 4370.—Ontonagon: NE of Buckshot Cabin along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, Oct 1976, *Malachowski* 5569.

Caloplaca chrysodeta (Vainio ex Räsänen) Domb. - saxicolous, on calcareous rocks; UP: 2, LP: 5.

Alpena (Harris 1977).

Caloplaca chrysophthalma Degel. - corticolous, on deciduous trees; UP: 3, LP: 1.

Baraga: woods E of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus tremuloides* woods, on *Populus tremuloides*, Sept 1972, *Harris* 7906.—Leelanau: Sleeping Bear Sand Dunes, on dead tree, Aug 1933, *Darlington* s.n.

Caloplaca cirrochroa (Ach.) Th. Fr. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Mackinac (Harris 1977).

Caloplaca citrina (Hoffm.) Th. Fr. - saxicolous, on siliceous and calcareous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Amygdaloid Island, S shore of Amygdaloid Lake, July 1959, *Wetmore 4611*.

Caloplaca cladodes (Tuck.) Zahlbr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, mouth of McCargo Cove, July 1983, *Wetmore 48003* (MIN); Isle Royale NP, SW of McGinty Cove, July 1984, *Wetmore 51990* (MIN).

Caloplaca conversa (Hoffm.) Th. Fr. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: High Rock Bay, along shore, of Lake Superior, with *Abies balsamea*, *Betula*, and *Pinus strobus*, on rock, Oct 1976, *Malachowski 4817*.—Ontonagon: Porcupine Mountains SP, Union Bay picnic ground, July 1976, *Pipoly 104C*.

Caloplaca discolor (Willey) Fink - corticolous; UP: 1, LP: 1.

Charlevoix: Beaver Island, bay N of Green Bay, on *Thuja*, Aug 1961, *Imshaug 27785*.—Chippewa: Lower Tahquamenon Falls, *Thuja-Fagus-Acer* forest, on *Thuja*, Aug 1957, *Imshaug 19905*.

Caloplaca epithallina Lynge - lichenicolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Caloplaca feracissima H. Magn. - saxicolous, on calcareous rocks; UP: 3, LP: 9.

Chippewa: Prentiss Bay, along coast, Aug 1949, *Imshaug 3813*.—Kalamazoo: Railroad crossing on 30th St, 0.3 mi S of C Ave, July 1970, *Harris 5967*.

Caloplaca ferruginea (Huds.) Th. Fr. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Caloplaca flavorubescens (Huds.) J. R. Laundon - corticolous, on deciduous trees; UP: 2, LP: 4.

Charlevoix: Beaver Island, Green Bay, on *Populus tremuloides*, Aug 1961, *Imshaug 27827*.—Leelanau: Sugarloaf, on *Tilia*, July 1961, *Imshaug 27395*.

Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth. - saxicolous, on calcareous rocks; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, SW end of West Caribou Island, July 1959, *Wetmore 4425*.

Caloplaca fraudans (Th. Fr.) H. Olivier - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Caloplaca grimmiae (Nyl.) H. Olivier - on *Candelariella vitellina*; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore 41399* (MIN); Isle Royale NP, Edwards Island, July 1983, *Wetmore 48446* (MIN).

Caloplaca holocarpa (Hoffm. ex Ach.) A. E. Wade - corticolous and saxicolous; UP: 6, LP: 12.

Keweenaw: Isle Royale NP, in *Betula-Abies* forest 100 m W of Hay Bay Campground, on *Populus tremuloides*, June 1977, *Malachowski* 5821.—Montmorency: 4 mi S of Atlanta, off County Rd 487, on *Populus tremuloides*, Aug 1974, *Wang* 927.

Caloplaca invadens Lynge - lichenicolous on *Lecanora* & *Physcia* spp.; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Caloplaca microphyllina (Tuck.) Hasse - corticolous, on old wood; UP: 0, LP: 2.

Leelanau: Sleeping Bear Dunes NL, gravel pit 2 mi S of Empire, on *Fraxinus pennsylvanica*, June 1987, *Wetmore* 57907 (MIN); Sleeping Bear Dunes NL, 3.5 mi NE of Glen Arbor, on *Acer saccharum*, July 1987, *Wetmore* 58345 (MIN).

Caloplaca obliterans (Nyl.) Blomb. & Forss. - saxicolous, on mildly calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Caloplaca oxfordensis Fink - saxicolous, on siliceous rocks; UP: 2, LP: 4.

Iron: old slate mine, near Kenton, Sept 1957, *Imshaug* 20765 (MIN).—Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore* 41359 (MIN).

Caloplaca parvula Wetmore - corticolous, on deciduous trees; UP: 1, LP: 0.

Mackinac: on Big Knob Rd near US 2, on *Acer saccharum*, May 1977, *Harris* 12327 (MIN).

Caloplaca pollinii (A. Massal.) Jatta - corticolous, on coniferous and deciduous trees; UP: 0, LP: 1.

Leelanau: Sleeping Bear Dunes NL, Glen Haven, Sleeping Bear Point, on *Juniperus*, July 1987, *Wetmore* 58244 (MIN).

Caloplaca saxicola (Hoffm.) Nordin - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: between Eagle Rocks & Eagle Harbor, on rocky outcrop, Oct 1980, *Rutkowski s.n.* (MIN).

Caloplaca sideritis (Tuck.) Zahlbr. - saxicolous, on siliceous rocks; UP: 1, LP: 1.

Keweenaw: Isle Royale NP (Wetmore 1997).—Washtenaw (Wetmore 1996).

Caloplaca sinapisperma (Lam. & DC.) Maheu & A. Gillet - terricolous and on plant debris; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, SW of Saginaw Point, July 1983, *Wetmore* 46945 (MIN).

Caloplaca stellata Wetmore & Kärnefelt - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, 1 mi S of Huginnin Cove, July 1984, *Wetmore* 52851 (MIN).

Caloplaca ulmorum (Fink) Fink - corticolous, on deciduous trees; UP: 1, LP: 2.

Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug* 58970.—Newaygo: *Quercus alba* trees along road, Apr 1958, *Imshaug* 21199B.

Caloplaca vitellinula (Nyl.) H. Olivier - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Washington Harbor, Johns Island, June 1958, *Wetmore* 2088 (MIN); Isle Royale NP, Huginnin Cove, July 1984, *Wetmore* 52277 (MIN).

Candelaria concolor (Dickson) Stein - corticolous, on deciduous trees; UP: 11, LP: 38.

Clinton: NW side of Rose Lake, in a very moist deciduous forest, July 1979, *Fruit 5A*.—Ingham: MSU Campus, E side of Baker Woodlot, fallen branch, Nov 1973, *Harris 8545*.

Candelaria fibrosa (Fr.) Müll. Arg. - corticolous, on deciduous trees; UP: 4, LP: 8.

Emmet: Wilderness State Park, Sept 1962, *Harris s.n.*.—Mecosta: near Paris, in old bog, on *Populus tremuloides*, Apr 1958, *Imshaug 21240*.

Candelariella aurella (Hoffm.) Zahlbr. - saxicolous, on calcareous rocks; UP: 3, LP: 0.

Keweenaw: Davidson Island, along shores and rocky cliffs, June 1958, *Wetmore 2594A*; rocky shore of Lake Superior at Five-Mile Point, Sept 1957, *Imshaug 20893*.

Candelariella efflorescens R. C. Harris & W. R. Buck - corticolous; UP: 8, LP: 31.

Keweenaw: Isle Royale NP, Cork Island, SE of Belle Isle, *Thuja*, *Abies*, *Betula*, *Picea* forest, on *Picea*, June 1977, *Malachowski 6103C*.—Oscoda: near Wagner Lake, ca 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, on *Populus grandidentata*, Sept 1973, *Harris 8247*.

Candelariella vitellina (Hoffm.) Müll. Arg. - saxicolous, on siliceous rocks; UP: 9, LP: 18.

Huron: Lake Huron, Eagle Bay, Point Aux Barques, sandstone quarry, May 1958, *Imshaug 21541*.—Iron: Kenton, old slate mine, Sept 1957, *Imshaug 20774*.

Candelariella xanthostigma (Ach.) Lettau - corticolous, on deciduous trees; UP: 1, LP: 15.

Benzie: Benzie State Park, forested sand dunes, on *Quercus*, July 1961, *Imshaug 27454*.—Jackson: Big Portage Lake, open abandoned field, on *Quercus*, June 1957, *Imshaug 19752*.

Canomaculina subtinctoria (Zahlbr.) Elix (syn. *Rimeliella subtinctoria*) - corticolous, on deciduous trees; UP: 0, LP: 1.

Benzie: Sleeping Bear Dunes NL, Platte Point, on *Quercus rubra*, June 1987, *Wetmore 58085* (MIN).

Catillaria globulosa (Flörke) Th. Fr. - corticolous, on deciduous trees; UP: 1, LP: 0.

Delta: Charboneau Point, *Thuja* swamp, Sept 1976, *Harris 11775A* (MICH).

Catillaria lenticularis (Ach.) Th. Fr. - saxicolous, on calcareous rock; UP: 1, LP: 1.

Mackinac: (Harris 1977).

Catillaria nigroclavata (Nyl.) Schuler - corticolous, on deciduous trees; UP: 4, LP: 8.

Cheboygan: E of Pine Grove Campground, *Pinus banksiana-Populus* woods, on *Populus tremuloides*, Aug 1972, *Harris 7797*.—Oscoda: ca. 7.5 mi S of Mio, moist *Quercus-Acer rubrum* woods W of Watson Rd, on *Populus grandidentata*, Sept 1973, *Harris 8394B*.

Catillaria tristis (Müll. Arg.) Arnold - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Mackinac: E of Cedarville, N of Mich Hwy 134, on limestone boulders, Aug 1967, *Harris 3728A*.

Catinaria atropurpurea (Schaerer) Vezda & Poelt - corticolous; UP: 5, LP: 3.

Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, *Harris 7501*.

Cetraria arenarea Kärnefelt - terricolous, on dry ground; UP: 6, LP: 9.

Charlevoix: Beaver Island, Iron Ore Bay, Aug 1961, *Imshaug* 27702.—Schoolcraft: Lake Michigan, Seul Choix Point, sand dunes, Aug 1957, *Imshaug* 20395.

Cetraria ericetorum Opiz subsp. **ericetorum** - terricolous, on dry ground; UP: 1, LP: 1.

Keweenaw: Gay, 15 mi E of Calumet, July 1976, *Erbisch* 4216 (MIN); Isle Royale NP, West Caribou Island, July 1983, *Wetmore* 46632 (MIN).

Cetraria ericetorum subsp. **reticulata** (Räsänen) Kärnefelt - terricolous, on dry ground; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Moskey Basin near Rock Harbor, July 1957, *Wetmore* 427; Isle Royale NP, Jackpine Point, about halfway down bay on N side between Conglomerate Bay and Tonkin Bay, July 1959, *Wetmore* 4277.

Cetraria islandica (L.) Ach. subsp. **islandica** - terricolous, on dry ground; UP: 1, LP: 3.

Charlevoix: Beaver Island, North End Bay, Aug 1961, *Imshaug* 27549 (MIN).—Keweenaw: Isle Royale NP, South Government Island, July 1984, *Wetmore* 53309 (MIN).

Cetraria islandica subsp. **crispiformis** (Räsänen) Kärnefelt - terricolous, on dry ground; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, rocky shore (exposed to Lake Superior and faces NW) of Capt. Kidd Island (NE of Amygdaloid Island), July 1959, *Wetmore* 4677, 4683.

Cetrelia cetrarioides (Duby) Culb. & C. Culb. - corticolous, on mossy trees, and saxicolous, on rocks in swamps and moist woods; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Siskiwit Falls River, on *Thuja*, June 1958, *Wetmore* 2401.

Cetrelia chicitae (Culb.) Culb. & C. Culb. - corticolous, on mossy trees, and saxicolous, on rocks in swamps and moist woods; UP: 5, LP: 1.

Alger: Pictured Rocks NL, S of Miners Falls, on *Thuja*, July 1987, *Wetmore* 59567.—Keweenaw: Isle Royale NP, SW of McGinty Cove, July 1984, *Wetmore* 52075.

Cetrelia olivetorum (Nyl.) Culb. & C. Culb. - corticolous, on mossy trees, and saxicolous, on rocks in swamps and moist woods; UP: 12, LP: 7.

Delta: along Haymeadow Creek Falls Nature Trail on County Rd 509, NE of Rapid River, wet woods, old fallen *Thuja*, Sept 1969, *Harris* 4199.—Marquette: Huron Mts, Middle Falls, Salmon-Trout River, *Pinus*, *Betula*, and *Tsuga*, Oct 1976, *Malachowski* 4330.

Chaenotheca brachypoda (Ach.) Tibell - lignicolous and corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Chaenotheca brunneola (Ach.) Müll. Arg. - lignicolous and corticolous; UP: 5, LP: 4.

Charlevoix: Beaver Island, Iron Ore Bay, on *Abies*, Aug 1961, *Imshaug* 27707.—Cheboygan: along Carp Creek N of Hogsback Rd, *Thuja* swamp, on old stump, July 1974, *Harris* 8943.

Chaenotheca chrysocephala (Turner ex Ach.) Th. Fr. - corticolous, on coniferous trees; UP: 4, LP: 1.

Gogebic: Great Conglomerate Falls of Black River, mixed hardwood-conifer forest, Sept 1957, *Imshaug* 20703.—Keweenaw: about 2 mi NE of Windigo on Windigo Mine Trail, June 1958, *Wetmore* 1840.

Chaenotheca cinerea (Pers.) Tibell - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Chaenotheca ferruginea (Turner & Borrer) Mig. - corticolous, on deciduous and coniferous trees; UP: 4, LP: 2.

Keweenaw: Isle Royale NP, West Caribou Island, on *Betula*, July 1983, *Wetmore 46658* (MIN).—Mackinac: 40 mi W of St. Ignace, on *Pinus resinosa*, Aug 1977, *Wetmore 29761* (MIN).

Chaenotheca furfuracea (L.) Tibell - corticolous, on tree roots and stumps; UP: 6, LP: 2.

Baraga: swamp NE of Sturgeon River Campground, 5 mi NE of Sidnaw, Sept 1972, *Harris 7887*.—Clinton: E of Hinman Rd, S of unnamed tributary of Maple River, *Thuja* swamp, on humus in roots of fallen tree, Nov 1973, *Harris 8488*.

Chaenotheca hispidula (Ach.) Zahlbr. - corticolous, on deciduous trees; UP: 2, LP: 1.

Cheboygan: 7 mi W of Cheboygan, Aug 1977, *Wetmore 29804* (MIN).—Keweenaw: Isle Royale NP, SE Huginnin Cove, on *Acer saccharum*, July 1984, *Wetmore 52441*.

Chaenotheca laevigata Nádv. - lignicolous; UP: 4, LP: 0.

Alger: Pictured Rocks NL, Munising, Sand Point, on *Thuja*, July 1987, *Wetmore 59691* (MIN).—Keweenaw: Isle Royale NP, New Feldtman Tower, N slope, on *Thuja*, July 1983, *Wetmore 48605* (MIN).

Chaenotheca phaeocephala (Turner) Th. Fr. - lignicolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Chaenotheca stemonea (Ach.) Müll. Arg. - lignicolous; UP: 4, LP: 2.

Cheboygan: 7 mi W of Cheboygan, Aug 1977, *Wetmore 29809* (MIN).—Keweenaw: Isle Royale NP, 0.5 mi E of Long Point, on *Picea mariana* stump, July 1984, *Wetmore 52660* (MIN).

Chaenotheca trichialis (Ach.) Th. Fr. - corticolous, on deciduous and coniferous trees; UP: 4, LP: 1.

Alger: Pictured Rocks NL, S of Miners Falls, on *Thuja*, July 1987, *Wetmore 59555* (MIN).—Keweenaw: Isle Royale NP, NE side of Moskey Basin, on *Thuja* snag, July 1983, *Wetmore 48321* (MIN).

Chaenotheca xyloxena Nádv. - lignicolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE side of Moskey Basin, on *Abies balsamea* snag, July 1983, *Wetmore 48370* (MIN); Isle Royale NP, 0.5 mi E of Windigo, on *Abies balsamea* snag, July 1984, *Wetmore 51851* (MIN).

***Chaenothecopsis consociata** (Nádv.) A. F. W. Schmidt - lichenicolous, on *Chaenotheca chrysocephala*; UP: 2, LP: 0.

Gogebic: 2 mi SE of Marenisco, [on lichen] on *Thuja*, July 1975, *Harris 10017* (MIN).—Keweenaw: Isle Royale NP, across from Clay Island, [on lichen] on *Picea*, July 1983, *Wetmore 47702* (MIN).

†**Chaenothecopsis debilis** (Turner & Borrer ex Sm.) Tibell - lignicolous and corticolous; UP: 2, LP: 1.

Keweenaw: Isle Royale NP, New Feldtman Tower, S slope, on *Thuja* snag, July 1983, *Wetmore 48660* (MIN).—Mackinac: 40 mi W of St. Ignace, on *Abies balsamea*, Aug 1977, *Wetmore 29768* (MIN).

†**Chaenothecopsis pusilla** (Ach.) A. F. W. Schmidt - lichenicolous, on *Chaenotheca* and *Calicium* spp.; UP: 3, LP: 2.

Gogebic: N of Bobcat Lake Campground, [on lichen] on conifer stump, July 1975, *Harris 10066* (MIN).—Keweenaw: Isle Royale NP, swamp E of Feldtmann Lake, [on lichen] on conifer snag, July 1984, *Wetmore 52873* (MIN).

†**Chaenothecopsis pusiola** (Ach.) Vainio (syn. *C. lignicola*) - lichenicolous, on *Chaenotheca* spp.; UP: 3, LP: 2.

Keweenaw: Isle Royale NP, bay N of Stockly Bay, [on lichen] on conifer snag, July 1983, *Wetmore 49765* (MIN).—Mackinac: Rick River Rd, [on lichen] on conifer stump, May 1977, *Harris 12549* (MIN).

†**Chaenothecopsis rubescens** Vainio - corticolous; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Middle Point SE of Washington Island, on *Thuja*, July 1984, *Wetmore 51734* (MIN).

†**Chaenothecopsis savonica** (Räsänen) Tibell - lignicolous; UP: 1, LP: 1.

Alger: Pictured Rocks NL, 0.5 mi SW of Hurricane River Campground, [on lichen] on *Thuja*, July 1987, *Wetmore 59293* (MIN).—Benzie: Sleeping Bear Dunes NL, 1 mi S of Platte River Point, June 1987, *Wetmore 58105* (MIN).

***Chaenothecopsis viridialba** (Kremp.) A. F. W. Schmidt - lichenicolous, on crustaceous lichens; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE side of Moskey Basin, [on lichen] on *Thuja*, July 1983, *Wetmore 48386* (MIN).

†**Chaenothecopsis viridireagens** (Nádv.) A. F. W. Schmidt - lichenicolous, on *Chaenotheca brunneola*; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, across from Clay Island, July 1983, *Wetmore 47742* (MIN); Isle Royale NP, bay N of Stockly Bay, [on lichen] on *Thuja*, July 1983, *Wetmore 49828* (MIN).

Chromatochlamys muscorum (Fr.) H. Mayrh. & Poelt - muscicolous, on mossy trees and rocks; UP: 1, LP: 0.

Keweenaw: on shoreline ca. 3 mi W of Copper Harbor, W end of Hebbard Park, ca. 6 m from the Lake, growing over mosses on relatively high, NW-facing slope of shoreline rocks, Aug 1980, *Reschke 1352* (MICH).

Chrysothrix candelaris (L.) J. R. Laundon - corticolous; UP: 4, LP: 2.

Alger: Pictured Rocks NL, AuSable Point, on dead *Abies balsamea*, July 1987, *Wetmore 59070* (MIN).—Keweenaw: Isle Royale NP, Checker Point, on *Abies balsamea* snag, July 1983, *Wetmore 48771* (MIN).

Chrysothrix chlorina (Ach.) J. R. Laundon - saxicolous, on shaded siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Cladina arbuscula (Wallr.) Hale & Culb. - terricolous, on dry heaths; UP: 13, LP: 17.

Delta: near Bill's Creek at County Rd 509, NE of Rapid River, dry *Pinus banksiana* woods, Sept 1969, *Harris 4160*.—Roscommon: Houghton State Forest, W of US Hwy 27, dry *Pinus banksiana* forest, Oct 1968, *Ohlsson 60*.

Cladina mitis (Sandst.) Hustich - terricolous, on dry heaths; UP: 13, LP: 29.

Oscoda: near Wagner Lake ca. 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, Sept 1973, *Harris* 8197.—Otsego: just W of Pigeon River State Forest, meadows or beaver marsh, July 1976, *Pipoly* 265.

Cladina rangiferina (L.) Nyl. - terricolous, on dry heaths; UP: 14, LP: 38.

Alger: 500 m S of Twelve-Mile Beach Campground, *Pinus strobus*, *P. banksiana*, *Abies balsamea*, and *Betula*, Oct 1976, *Malachowski* 2692.—Chippewa: Drummond Island, E side of Bass Cove, Oct 1976, *Imshaug* 59839.

Cladina stellaris (Opiz) Brodo - terricolous, on dry heaths; UP: 14, LP: 10.

Cheboygan: 1.3 mi W of Univ. of Mich. Biological Station entrance on Riggsville Rd, *Cladina* barrens and dry woods with *Populus*, *Acer rubrum*, *Quercus nigra*, *Pinus strobus*, and *P. resinosa*, June 1991, *Bourell* 3976.

Cladina stygia (Fr.) Ahti - terricolous, on boggy ground; UP: 2, LP: 0.

Alger: Pictured Rocks NL, E side of Grand Portal Point, July 1987, *Wetmore* 59781 (MIN).—Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore* 49632 (MIN).

Cladonia acuminata (Ach.) Norrlin - terricolous, on calcareous soils; UP: 6, LP: 4.

Chippewa: Lower Tahquamenon Falls, *Fagus-Acer* forest, Aug 1957, *Imshaug* 19907.—Charlevoix: Beaver Island, Pizgah Dunes, Donegal Bay, Aug 1961, *Imshaug* 27606.

Cladonia amaurocraea (Flörke) Schaerer - saxicolous, on mossy boulders, etc; UP: 2, LP: 1.

Keweenaw: along base of cliff on Cliff Drive, 3 km S of Route 41, June 1977, *Malachowski* 5664; Isle Royale NP, rocky western headland of McCargo Cove, mostly *Picea* but some *Populus*, *Betula*, and *Abies*, on rock, June 1977, *Malachowski* 6268.

Cladonia bacilliformis (Nyl.) Glück - corticolous, on coniferous trees; UP: 2, LP: 1.

Benzie: Sleeping Bear Dunes NL, Platte Point, June 1987, *Wetmore* 58042 (MIN).—Keweenaw: Isle Royale NP, across from Clay Island, July 1983, *Wetmore* 47739 (MIN).

Cladonia botrytes (K. Hagen) Willd. - tree stumps; UP: 9, LP: 3.

Chippewa: Bayview Campground, along shore of Lake Superior, in *Acer*, *Betula*, *Pinus banksiana* forest, July 1977, *Malachowski* 7291.—Keweenaw: N of Lake Addie, swampy area with *Abies* and *Betula*, Oct 1976, *Malachowski* 4904A.

Cladonia brevis (Sandst.) Sandst. - terricolous; UP: 1, LP: 3.

Ontonagon: Porcupine Mountains, summit of escarpment above Lake of the Clouds, cliff ledge, Sept 1957, *Imshaug* 20435.—Oscoda: between Watson Rd and Union Corners Rd about 7 mi S of Mio, *Pinus banksiana-Quercus* woods, Sept 1973, *Harris* 8382.

Cladonia caespiticia (Pers.) Flörke - corticolous, on mossy tree stumps; UP: 6, LP: 9.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, Sept 1972, *Harris* 7947.—Ingham: MSU Campus, Baker Woodlot, managed area, on base of *Quercus*, Nov 1973, *Harris* 8437.

Cladonia cariosa (Ach.) Sprengel - terricolous, on exposed, sandy, calcareous soils; UP: 10, LP: 11.

Baraga: old borrow pit near Sturgeon River Bridge, 5 mi NE of Sidnaw, Sept 1972, *Harris* 8047.—Ingham: Dansville State Game Area, dry fields W of Howard Rd, on soil, June 1972, *Harris* 7747.

Cladonia carneola (Fr.) Fr. - terricolous, on humus-rich soil; UP: 2, LP: 0.

Alger: near AuTrain, along coast of Lake Superior at Scott Falls, Aug 1957, *Imshaug* 20228.—
Ontonagon: Porcupine Mountains, summit of escarpment NW of Lake of the Clouds, Sept 1957,
Imshaug 20521.

Cladonia caroliniana Tuck. - terricolous; UP: 0, LP: 1.

Ogemaw: in *Pinus banksiana* area, Sept 1959, *Imshaug* 25390.

Cladonia cenotea (Ach.) Schaerer - terricolous, on humus-rich soil; UP: 12, LP: 6.

Baraga: sandy shore of Lake Superior 500 m W of mouth of Huron River, *Pinus banksiana*,
scattered *Acer* and *Pinus resinosa*, July 1977, *Malachowski* 6376.—Keweenaw: along shore of
Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug* 58928.

Cladonia cervicornis (Ach.) Flotow subsp. **cervicornis** - terricolous, on acid soils,
and saxicolous, on boulders; UP: 13, LP: 25.

Keweenaw: Isle Royale NP, inside Chippewa Harbor, July 1983, *Wetmore* 47196 (MIN).—Shia-
wassee: Rose Lake Experimental Station, Apr 1957, *Wetmore* 25 (MIN).

Cladonia cervicornis subsp. **verticillata** (Hoffm.) Ahti - terricolous, on acid soils,
and saxicolous, on boulders; UP: 11, LP: 17.

Huron: near Caseville, on sandy soil under *Pinus*, June 1957, *Imshaug* 19641.—Leelanau: Lake
Michigan, along shore of Lake Michigan at Lighthouse Point, N tip of Leelanau Peninsula, June
1957, *Imshaug* 19506.

Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel - mossy soils and boulders;
UP: 14, LP: 35.

Charlevoix: Beaver Island, Donegal Bay, Pizgah Dunes, Aug 1961, *Imshaug* 27607.—Newaygo:
between White Cloud and Newaygo, base of *Quercus alba*, June 1957, *Imshaug* 19869.

Cladonia coccifera (L.) Willd. - mossy soils and boulders; UP: 1, LP: 0.

Keweenaw: Lake Superior at Five-Mile Point, rocky shore, Sept 1957, *Imshaug* 20873; Isle
Royale NP, cliffs back from shore on main island across from Clay Island, in bay S of Robinson
Bay, on rock cliffs, July 1959, *Wetmore* 4544.

Cladonia coniocraea (Flörke) Sprengel - corticolous, on decaying wood; UP: 15,
LP: 32.

Ontonagon: Porcupine Mountains, Mirror Lake, on *Betula*, Sept 1957, *Imshaug* 20627.—School-
craft: Indian Lake, around Big Spring, *Thuja* bog, Aug 1957, *Imshaug* 20008.

Cladonia conista A. Evans - terricolous, on humus-rich soil; UP: 1, LP: 4.

Marquette: Huron Mountain Club (Manierre 1999).

Cladonia cornuta (L.) Hoffm. - corticolous, on decaying coniferous wood; UP: 8,
LP: 2.

Dickinson: road into O'Neil Lake Campground, *Picea-Pinus banksiana-Populus* woods, Sept
1971, *Harris* 7382.—Keweenaw: N side of Gay, shore of Lake Superior with low cliffs, and
adjacent woods with *Sphagnum* and boulders, July 1976, *Imshaug* 59142.

Cladonia crispata (Ach.) Flotow - terricolous, on acidic ground; UP: 11, LP: 12.

Chippewa: Lower Tahquamenon Falls, open *Populus* woods with *Pteridium aquilinum*, Aug
1957, *Imshaug* 19945.—Roscommon: SW part of county, *Pinus banksiana* woods, May 1958,
Imshaug 21292B.

Cladonia cristatella Tuck. - terricolous; UP: 15, LP: 43.

Clare: *Chamaedaphne* bog, scattered *Pinus banksiana* and *Populus* on sandy soil, May 1959, *Erbisch 104*.—Ontonagon: Porcupine Mountains, summit of escarpment NW of Lake of the Clouds, Sept 1957, *Imshaug 20527*.

Cladonia cryptochlorophaea Asah. - terricolous, on humus-rich soil; UP: 5, LP: 12.

Keweenaw: Isle Royale NP, Outer Hill Island, July 1980, *Wetmore 41527* (MIN).—Washtenaw: NW of Mill Lake, Feb 1975, *Harris 9818* (MIN).

Cladonia cyanipes (Sommerf.) Nyl. - mossy rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49639* (MIN).

Cladonia cylindrica (A. Evans) A. Evans - terricolous and also on decaying wood; UP: 0, LP: 4.

Gladwin: Gladwin, old field with scattered *Thuja*, Apr 1958, *Imshaug 21039*.—Ingham: MSU campus, East Lansing, middle of Baker Woodlot, on rotted stump, Mar 1974, *Harris 8633*.

Cladonia dahliana Kristinsson - terricolous, on acidic soils; UP: 4, LP: 1.

Chippewa: Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug 60137*.

Cladonia decorticata (Flörke) Sprengel - terricolous, on earth and sand; UP: 2, LP: 4.

Oscoda: E of Wagner Lake ca. 7 mi S of Mio, *Pinus banksiana* woods, Sept 1973, *Harris 8329*.

Cladonia deformis (L.) Hoffm. - terricolous, on humus-rich soil; UP: 10, LP: 7.

Baraga: 3 km WSW of mouth of Huron River, *Abies*, *Betula*, *Pinus* forest, July 1977, *Malachowski 6413*.—Chippewa: Bayview Campground, along shore of Lake Superior, *Acer*, *Betula*, *Pinus banksiana* forest, July 1977, *Malachowski 7288*.

Cladonia digitata (L.) Hoffm. - corticolous, on decaying wood; UP: 11, LP: 8.

Cheboygan: W side of Hebron Mail Rd, N of Levering Rd, *Thuja* swamp, on rotten stump, Sept 1973, *Wang 444*.—Dickinson: road into O'Neil Lake Campground, *Pinus banksiana*-*Populus-Picea* woods, on rotten stump, Sept 1971, *Harris 7490*.

Cladonia ecmocyna Leighton - among boulders; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Cladonia farinacea (Vainio) A. Evans - sandy soils, tree bases; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Cladonia fimbriata (L.) Fr. - rotten wood, open soil; UP: 9, LP: 11.

Baraga: 3 km WSW of mouth of Huron River, *Abies*, *Betula*, *Pinus* forest, July 1977, *Malachowski 6405*.—Oscoda: E of Wagner Lake, ca. 7 mi S of Mio, *Pinus banksiana* woods, Sept 1973, *Harris 8327A*.

Cladonia floerkeana (Fr.) Flörke - usually terricolous, on open ground; UP: 1, LP: 1.

Cheboygan: SW of intersection of Burt Lake and Hardwood Rds, old field, on old log, July 1974, *Harris 9021*.—Keweenaw: Isle Royale NP, Siskowit Lake, near camp site, June 1953, *Bazuin 9375*.

Cladonia furcata (Hudson) Schrader - terricolous, on open, acidic ground; UP: 9, LP: 8.

Baraga: Point Abbays, low lying forest with standing water, *Pinus strobus*, *Betula*, *Fraxinus*, *Acer* forest, July 1977, *Malachowski* 6425.—Chippewa: Drummond Island, old field E of Bruce Point, Oct 1976, *Imshaug* 60070.

***Cladonia gracilis* (L.) Willd.** - terricolous, on heathy soils; UP: 15, LP: 18.

Baraga: 500 m W of mouth of Huron River, shore of Lake Superior with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, July 1977, *Malachowski* 6362B.—Chippewa: Bayview Campground, *Acer*, *Betula*, *Pinus banksiana* forest along the shore of Lake Superior, July 1977, *Malachowski* 7287.

***Cladonia grayi* G. Merr. ex Sandst.** - terricolous, on peat bogs, and corticolous, on coniferous trees; UP: 10, LP: 24.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, July 1977, *Malachowski* 6353.—Roscommon: Harrison Tote Rd ca. 1 mi W of US Hwy 27, *Pinus banksiana* woods, Oct 1971, *Harris* 7679.

***Cladonia humilis* (With.) J. R. Laundon** - terricolous, on open soils and dunes; UP: 5, LP: 10.

Arenac: Point Lookout, June 1957, *Imshaug* 19391.—Menominee: between Bass and Resort Lakes, in *Pinus banksiana* and *Quercus* woods, Aug 1957, *Imshaug* 20302.

***Cladonia incrassata* Flörke** - on peat and decaying wood; UP: 0:, LP: 9.

Jackson: S of Flansburgh Rd, ca. 1 mi E of US Hwy 127, swamp, Sept 1974, *Harris* 9555.—Newaygo: Dudgeon swamp, S of One-Mile Rd, ENE of White Cloud, Oct 1972, *Harris* 8160.

Cladonia macilenta* Hoffm. var. *macilenta - terricolous, on humus-rich soil; UP: 7, LP: 4.

Cheboygan: on N side of Orchard Beach Rd, 1 mi E of Alverno, *Thuja* swamp, stump in sandy clearing, June 1973, *Wang* 108.—Chippewa: Drummond Island, along shore N of Bruce Point, in mixed conifer-hardwoods, Oct 1976, *Imshaug* 59986.

***Cladonia macilenta* var. *bacillaris* (Genth) Schaerer** - terricolous, on humus-rich soil; UP: 10, LP: 22.

Chippewa: along shore of Lake Superior, Bayview Campground, in *Acer*, *Betula*, *Pinus banksiana* forest, July 1977, *Malachowski* 7273.—Dickinson: at S end of O'Neil Lake, *Thuja-Picea* swamp, Sept 1971, *Harris* 7561.

***Cladonia macrophylla* (Schaerer) Stenh.** - terricolous, on open ground; UP: 1, LP: 0.

Marquette (*Harris* 1977).

***Cladonia maxima* (Asah.) Ahti** - terricolous, on damp heaths and woods; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, outside of Locke Point, July 1983, *Wetmore* 47432 (MIN); Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore* 49642 (MIN).

***Cladonia merochlorophaea* Asah.** - terricolous, on humus in coniferous forests; UP: 9, LP: 3.

Keweenaw: Isle Royale NP, on S side of Passage Island, dead *Abies*, July 1959, *Wetmore* 5321.—Schoolcraft: Indian Lake, around Big Spring, *Thuja* bog, Aug 1957, *Imshaug* 20021.

***Cladonia multiformis* G. Merr.** - moist soil and decaying wood; UP: 12, LP: 12.

Kalkaska: near Kalkaska, *Larix* and *Chamaedaphne* bog, June 1957, *Imshaug* 19461.—Keweenaw: shore of Lake Superior with low cliffs, and adjacent woods, N side of Gay, *Sphagnum* and boulders, July 1976, *Imshaug* 59187.

Cladonia ochrochlora Flörke - corticolous, on decaying wood; UP: 1, LP: 1.

Marquette: Huron Mountain Club (Manierre 1999).

Cladonia parasitica (Hoffm.) Hoffm. - corticolous, on decaying wood; UP: 3, LP: 11.

Chippewa: along shore of Lake Superior, Bayview Campground, in *Acer*, *Betula*, *Pinus banksiana* forest, on stump, July 1977, *Malachowski 7274E*.—Keweenaw: between Lac La Belle, and Deer Lake, sandy area with *Populus*, *Pteridium aquilinum*, and *Cladina* mats, July 1976, *Imshaug 58806*.

Cladonia peziziformis (With.) J. R. Laundon - terricolous, on calcareous heaths; UP: 1, LP: 14.

Clinton: Rose Lake Game Area, SE of junction of Clark and Peacock Rds, old fields, Oct 1971, *Harris 7684*.—Eaton: Grand Ledge, Fitzgerald Park, abandoned quarry, on open, barren soil, May 1959, *Erbisch 50*.

Cladonia phyllophora Hoffm. - rock outcrops and bare soil; UP: 11, LP: 17.

Lake: near Baldwin, in *Pinus banksiana-Quercus alba* woods, Apr 1958, *Imshaug 21182*.—Ogemaw: open sandy low area with *Pinus banksiana*, Sept 1959, *Imshaug 25424*.

Cladonia piedmontensis G. Merr. - terricolous; UP: 0, LP: 5.

Ingham: Dansville State Game Area, W of Howard Rd, dry fields, on soil, June 1972, *Harris 7733*.—Jackson: N of junction of Clear Lake and Green Rds, dry field, June 1970, *Harris 5935*.

Cladonia pleurota (Flörke) Schaerer - open ground and rocks; UP: 7, LP: 10.

Alger: 1 km E of Hurricane River Campground along shore of Lake Superior, *Abies*, *Betula alleghaniensis*, *Acer*, and *Thuja*, Oct 1976, *Malachowski 2637*.—Calhoun: on a ridge in the forest by Goose Lake, on soil, May 1969, *Ohlsson 152*.

Cladonia pocillum (Ach.) Grognot - terricolous, on calcareous ground; UP: 1, LP: 1.

Keweenaw: Isle Royale NP (Wetmore 1997).

Cladonia polycarpoides Nyl. - terricolous, on calcareous ground; UP: 0, LP: 15.

Ingham: Dansville State Game Area, W of Howard Rd, dry fields, on soil, June 1972, *Harris 7740*.—Shiawassee: along S branch of Looking Glass River, dry hills reforested with *Pinus*, July 1979, *Fruit 9*.

Cladonia pyxidata (L.) Hoffm. - terricolous, on open ground; UP: 12, LP: 25.

Keweenaw: N of Lake Addie, swampy area with *Abies* and *Betula*, Oct 1976, *Malachowski 4913*.—Marquette: Huron Mountains, Middle Falls, Salmon-Trout River, *Pinus*, *Betula*, and *Tsuga*, Oct 1976, *Malachowski 4331*.

Cladonia ramulosa (With.) J. R. Laundon - usually terricolous, on open ground; UP: 7, LP: 14.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, June 1973, *Wang 81*.—Eaton: Grand Ledge, Fitzgerald Park, near swamp, on boulders, Nov 1961, *Brodo 3456*.

Cladonia rei Schaerer - terricolous, on mineral or calcareous soils; UP: 11, LP: 30.

Charlevoix: Beaver Island, bluff near Barney Lake, Aug 1961, *Imshaug 27758*.—Washtenaw: NW corner of Crooked Lake, dry road bank, June 1970, *Harris 5922*.

Cladonia robbinsii A. Evans - terricolous, on dry soil; UP: 0, LP: 2.

Allegan: dry field E of 48th St. ca. 0.25 mi S of 126th Ave., July 1970, *Harris 5971*.—Newaygo: ENE of Newaygo, dry field W of Oak Rd, June 1972, *Harris 7752*.

Cladonia scabriuscula (Delise) Nyl. - mossy rocks and open heaths; UP: 9, LP: 2.

Gogebic: Sandstone Falls of Black River, mixed hardwoods-conifers, Sept 1957, *Imshaug* 20715.—
Presque Isle: shore of Lake Huron on point near Presque Isle Lighthouse, June 1958, *Imshaug* 22123.

Cladonia sobolescens Nyl. ex Vainio - terricolous, on sandy soils; UP: 1, LP: 2.

Washtenaw (Harris 1977).

Cladonia squamosa Hoffm. - bogs, mossy rocks; UP: 14, LP: 16.

Chippewa: Drummond Island, E side of Bass Cove, Oct 1976, *Imshaug* 59850.—Oscoda: E branch of Big Creek downstream from Mapes Rd, *Thuja-Picea* swamp, Sept 1973, *Harris* 8313.

Cladonia strepsilis (Ach.) Grognot - acid rocks and soil; UP: 0, LP: 2.

Benzie: Benzie State Park, forested sand dunes, on a sandy trail, July 1961, *Imshaug* 27428.—
Roscommon: along Harrison Tote Rd 1 mi W of old U.S. 27, dry *Pinus banksiana* woods, Oct 1968, *Harris* 3946.

Cladonia subulata (L.) F. H. Wigg. - terricolous, on open, mineral soils; UP: 5, LP: 1.

Baraga: along road N of Sturgeon River bridge, 5 mi NE of Sidnaw, Sept 1972, *Harris* 8051.—
Oscoda: W of Watson Rd, about 7.5 mi S of Mio, moist *Quercus-Acer rubrum* woods, Sept 1973, *Harris* 8416.

Cladonia sulphurina (Michaux) Fr. - usually terricolous, on humus-rich soils; UP: 4, LP: 0.

Alger: 1 km. E of Hurricane River campground, along shore of Lake Superior, *Abies*, *Betula alleghaniensis*, *Acer*, and *Thuja*, on *Thuja*, Oct 1976, *Malachowski* 2623C.—Keweenaw: shore of Lake Superior, N side of Gay, low cliffs, and adjacent woods with *Sphagnum* and boulders, July 1976, *Imshaug* 59133.

Cladonia symphycarpa (Flörke) Fr. - terricolous, on calcareous soils; UP: 4, LP: 4.

Keweenaw: Isle Royale NP, Mt Franklin, Aug 1972, *Wetmore* 21147 (MIN).—Leelanau: Sleeping Bear Dunes NL, Glen Haven, Sleeping Bear Point, July 1987, *Wetmore* 58252 (MIN).

Cladonia turgida Hoffm. - damp soils and rocks; UP: 9, LP: 7.

Benzie: Benzie State Park, forested sand dunes, July 1961, *Imshaug* 27423.—Charlevoix: Beaver Island, North End Bay, Aug 1961, *Imshaug* 27539.

Cladonia uncialis (L.) F. H. Wigg. - acid soils, rocks and bogs; UP: 13, LP: 24.

Lake: near Baldwin, *Pinus banksiana* woods, Apr 1958, *Imshaug* 21176.—Roscommon: SW part of county, *Pinus banksiana* woods, May 1958, *Imshaug* 21294.

Cladonia wainioi Savicz - saxicolous, on mossy boulders; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, West Caribou Island, July 1983, *Wetmore* 46617 (MIN); Isle Royale NP, 1 mi S of Huginnin Cove, July 1984, *Wetmore* 52772 (MIN).

Clauzadea monticola (Ach. ex Schaerer) Hafellner & Bellem. - saxicolous, on calcareous rocks; UP: 2, LP: 0.

Chippewa, Delta: on limestone (Harris 1977).

Cliostomum griffithii (Sm.) Coppins - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE of Thompson Island, on *Abies balsamea*, July 1984, *Wetmore* 51563 (MIN); Isle Royale NP, E of Rainbow Cove, on *Thuja*, July 1984, *Wetmore* 51909 (MIN).

Collema bachmanianum (Fink) Degel. - terricolous, on calcareous soils; UP: 1, LP: 1.

Mackinac (Harris 1977).—Presque Isle: Hammond Bay Biological Station, end of 2-track road, on ground, July 1979, *Rouse 48* (det. R. C. Harris) (MICH).

Collema coccophorum Tuck. - terricolous, on calcareous soils; UP: 1, LP: 0.

Marquette: Sugarloaf Mountain, on shore rocks, June 1933, *Lowe 2331A* (det. R. C. Harris) (MICH).

Collema conglomeratum Hoffm. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Amygdaloid Island, on *Populus tremuloides*, July 1984, *Wetmore 51523* (MIN).

Collema furfuraceum (Arnold) Du Rietz - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Wallace Lake, on *Populus tremuloides*, July 1983, *Wetmore 47642* (MIN); Isle Royale NP, New Feldtman Tower, S slope, on *Populus tremuloides*, July 1983, *Wetmore 48680* (MIN).

Collema fuscovirens (With.) J. R. Laundon - saxicolous, on calcareous rocks; UP: 4, LP: 1.

Houghton: Limestone Mt., W of Pelkie, on cliff, Sept 1949, *Imshaug 5088*.—Schoolcraft: Seul Choix Point, sand dunes along Lake Michigan, on limestone, Aug 1957, *Imshaug 20408*.

Collema glebulentum (Nyl. ex Crombie) Degel. - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, on outside (facing Lake Superior) along shore at SW end, on rock, June 1958, *Wetmore 1636A*.

Collema limosum (Ach.) Ach. - terricolous, on calcareous soils; UP: 0, LP: 1.

Benzie: Sleeping Bear Dunes NL, W end of Long Lake, N of Crystal Lake, June 1987, *Wetmore 58119* (MIN).

Collema nigrescens (Hudson) DC. - corticolous, on deciduous trees; UP: 4, LP: 1.

Keweenaw: Isle Royale NP, on hill behind Siskiwit Bay CCC camp directly behind cabins, on *Populus*, June 1958, *Wetmore 1765*; Isle Royale NP, on W side of McCargo Cove, 3 km from Cove mouth, *Abies*, *Populus*, and *Fagus* forest, *Populus tremuloides*, June 1977, *Malachowski 6294*.

Collema polycarpon Hoffm. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Hebard Park, coast of Lake Superior between Agate Harbor and Copper Harbor, on rock, Sept 1949, *Imshaug 4601*.

Collema pulcellum Ach. - corticolous, on deciduous trees; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, SE of Grace Creek bog, on fallen *Populus tremuloides*, July 1984, *Wetmore 52115* (MIN).—Marquette: Huron Mountains, Mt Ida, W side of Lake Ann, *Tsuga*, *Acer*, *Betula*, and *Pinus* forest, on *Acer*, Oct 1976, *Malachowski 4118B*.

Collema subflaccidum Degel. - corticolous, on deciduous trees; UP: 11, LP: 5.

Marquette: Huron Mountains, Mt Ida, W side of Lake Ann, *Tsuga*, *Acer*, *Betula* woods, on *Acer*, Oct 1976, *Malachowski 4118A*.—Ontonagon: Porcupine Mts, SW shore of Lake of the Clouds, *Populus*, *Betula*, and *Acer* woods, on *Acer*, Oct 1976, *Malachowski 5509*.

Collema tenax (Sw.) Ach. - usually terricolous, on calcareous soils; UP: 4, LP: 5.

Alger: Scott Falls near Au Train, on roof of cave, on rock, Aug 1967, *Harris 3716*.—Cheboygan: Reese's Bog, N shore of Burt Lake, July 1949, *Imshaug 3021*.

Collema undulatum Laurer ex Flotow - saxicolous, on calcareous rocks; UP: 5, LP: 0.

Chippewa: W of Detour along shore of Lake Huron, on rock, Aug 1949, *Imshaug 3864, 3866*.

Conotrema urceolatum (Ach.) Tuck. - corticolous, on deciduous trees; UP: 11, LP: 3.

Keweenaw: Bete Grise Bay, 350 m N of Mendota Canal, along shore of Lake Superior, *Abies*, *Betula*, and *Acer* woods, on *Acer*, Oct 1976, *Malachowski 5069*.—Ontonagon: Porcupine Mts, SW shore of Lake of the Clouds, *Populus*, *Betula*, and *Acer* woods, on *Acer*, Oct 1976, *Malachowski 5531*.

Cresponea chloroconia (Tuck.) Egea & Torrente - corticolous, on coniferous trees; UP: 7, LP: 7.

Keweenaw: Isle Royale NP, Lane Cove, on *Thuja*, July 1983, *Wetmore 36790* (MIN).—Lake: W of Irons, on *Thuja*, Sept 1968, *Harris 3870* (MIN).

Cyphelium lucidum (Th. Fr.) Th. Fr. - old coniferous bark and stumps; UP: 2, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Cyphelium tigillare (Ach.) Ach. - lignicolous; UP: 5, LP: 18.

Gratiot: 10 mi S of Ithaca along Route 27, Maple River flood area, Jan 1977, *Malachowski 1677*.—Wexford: S of Cadillac, fenceposts and scattered trees along disturbed roadside, June 1957, *Imshaug 19585*.

Cystocoleus ebeneus (Dillwyn) Thwaites - saxicolous, on shaded siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, SW end of Washington Island, June 1958, *Wetmore 2151*.

***Dactylospora inquilina** (Tuck.) Hafellner - lichenicolous, on *Pertusaria* sp.; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

†**Dactylospora stygia** (Berk. & Curt.) Hafellner - decaying wood; UP: 0, LP: 1.

Ingham: MSU, East Lansing, near Michigan Agricultural College, on decorticated wood, Dec 1891, *Hicks 161* (det. H. A. Imshaug).

Dermatocarpon luridum (With.) J. R. Laundon - saxicolous, on inundated rocks; UP: 7, LP: 0.

Baraga: Silver River, 5 mi E of L'Anse, over rocks, Sept 1949, *Imshaug 4476*.—Luce: Tahquamenon Falls State Park, below upper falls, on moist rock, Sept 1966, *Harris 1134*.

Dermatocarpon miniatum (L.) W. Mann - saxicolous, on calcareous rocks; UP: 7, LP: 0.

Chippewa: Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug 60123*.—Iron: Paint River near Crystal Falls, Sept 1957, *Imshaug 20821*.

Dermatocarpon moulinii (Mont.) Zahlbr. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Marquette: N shore of Presque Isle Point, N of Marquette, Sept 1949, *Imshaug* 5405.

Dimelaena oreina (Ach.) Norman - saxicolous, usually on siliceous rocks; UP: 3, LP: 0.

Chippewa: Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug* 60115.—Marquette: Huron Mountain, N end Mountain Lake, on granite cliff face on steep rocky hillside with mostly *Acer*, some *Pinus*, Oct 1976, *Malachowski* 3534.

Dimerella lutea (Dickson) Trevisan - usually corticolous, on mossy deciduous trees; UP: 6, LP: 3.

Keweenaw: Raspberry Island, two ridges with a swamp in center with *Sarracenia*, *Drosera*, and *Sphagnum*, few *Larix* in swamp, *Abies balsamea*, *Betula*, and some *Sorbus americana*, crust on mossy cliffs, June 1958, *Wetmore* 1563.—Wexford: Campside near junction of Anderson Creek and Little Mannistee River, *Populus*, *Acer*, *Quercus* woods, May 1977, *Common* 4078A.

Dimerella pineti (Ach.) Vezda - corticolous, on deciduous trees; UP: 4, LP: 8.

Clare: 2 mi N of Long Lake, *Thuja* swamp with *Ulmus* and *Fraxinus*, June 1973, *Common* 3151B.—Iosco: W of Oscoda, between River Rd and the AuSable River, *Thuja* swamp near river, May 1971, *Common* 232B.

Diploschistes muscorum (Scop.) R. Sant. - terricolous, on calcareous soils, initially lichenicolous on *Cladonia* spp.; UP: 3, LP: 4.

Clinton: Rose Lake Game Area, SE of junction of Clark and Peacock Rds, old fields, Oct 1971, *Harris* 7683.—Jackson: Sharonville State Game Area, E of Fishville Rd, dry fields, June 1970, *Harris* 5952.

Diploschistes scruposus (Schreber) Norman - usually saxicolous, on siliceous rocks; UP: 5, LP: 8.

Emmet: Maple River Dam, on log, June 1949, *Imshaug* 2865.—Marquette: Huron Mountains, hill at W end of Huron Mountains, Sept 1949, *Imshaug* 4735.

Diplotomma alboatrum (Hoffm.) Flotow - corticolous, on deciduous trees; UP: 2, LP: 2.

Baraga: along Sturgeon River ca. 0.25 mi N of campground, 5 mi NE of Sidnaw, moist woods, on *Ulmus*, Sept 1972, *Harris* 8108.—Newaygo: along roadside, on *Quercus alba*, Apr 1958, *Imshaug* 21203.

Diplotomma epipolium (Ach.) Arnold - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Diplotomma nivalis (Bagl. & Carestia) Hafellner - saxicolous, on vertical rocks (?initially lichenicolous on *Caloplaca* or *Xanthoria*); UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Endocarpon pulvinatum Th. Fr. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, in Rock Harbor, on rock shore and in *Picea*, *Abies*, *Betula*, *Populus* forest, in water trickle area, Aug 1972, *Wetmore* 21301; Isle Royale NP, NE tip of Passage Island, July 1983, *Wetmore* 47522 (MIN).

Endocarpon pusillum Hedwig - terricolous, on calcareous soils; UP: 1, LP: 3.

Keweenaw: Isle Royale NP, Johns Island, in Washington Harbor, July 1984, *Wetmore 51686* (MIN).

Ephebe lanata (L.) Vainio - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore 41372* (MIN); Isle Royale NP, Edwards Island, July 1983, *Wetmore 48502* (MIN).

Ephebe ocellata Hessen - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, North Government Island, July 1980, *Wetmore 41103* (MIN); Isle Royale NP, mouth of McCargo Cove, July 1983, *Wetmore 47991* (MIN).

Evernia mesomorpha Nyl. - corticolous, usually on coniferous trees; UP: 16, LP: 38.

Chippewa: Drummond Island, E side of Bass Cove, on *Thuja*, Oct 1976, *Imshaug 59892*.—Keweenaw: Isle Royale NP, SW point of Brady Cove, in *Populus*, *Betula*, *Abies* forest, on *Populus tremuloides*, June 1977, *Malachowski 6204A*.

Evernia prunastri (L.) Ach. - corticolous, on deciduous and coniferous trees; UP: 3, LP: 10.

Chippewa: Drummond Island, E side of Bass Cove, on *Populus*, Oct 1976, *Imshaug 59884*.—Presque Isle: point near Presque Isle Lighthouse, shore of Lake Huron, on *Abies*, June 1958, *Imshaug 22121*.

Farnoldia jurana (Schaerer) Hertel - saxicolous, on calcareous rocks; UP: 3, LP: 0.

Chippewa, Delta, and Mackinac: on limestone (Harris 1977).

Flavocetraria cucullata (Bellardi) Kärnefelt & Thell - terricolous, on open, calcareous soils; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, rocky point outside of Locke Point, July 1983, *Wetmore 47370* (MIN).

Flavoparmelia baltimorensis (Gyelnik & Főriss) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manfierre 1999).

Flavoparmelia caperata (L.) Hale - corticolous, on deciduous trees; UP: 14, LP: 40.

Shiawassee: along S branch of Looking Glass River, dry hills reforested with *Pinus*, July 1979, *Fruit 20*.

Flavopunctelia flaventior (Stirton) Hale - corticolous, on deciduous trees; UP: 5, LP: 21.

Chippewa: along shore of Lake Superior, Bayview Campground, in *Acer*, *Betula*, *Pinus banksiana* forest, July 1977, *Malachowski 7279A*.—Livingston: Brighton, along Conrad Rd, small bog, May 1966, *Harris 991*.

Flavopunctelia soledica (Nyl.) Hale - corticolous, on deciduous trees; UP: 2, LP: 9.

Baraga: about 0.25 mi NNE of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, on *Acer rubrum*, Sept 1972, *Harris 8027*.—Barry: E of Otis Lake, *Quercus* woods, on *Quercus*, July 1972, *Harris 7781*.

Fuscopannaria ahlneri (P. M. Jørg.) P. M. Jørg. - corticolous, on coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, West Caribou Island, July 1983, *Wetmore 46611* (MIN).

Fuscopannaria leucophaea (Vahl) P. M. Jørg. - saxicolous, on damp rocks; UP: 5, LP: 0.

Baraga: Falls River, L'Anse, Sept 1949, *Imshaug 5059*.—Marquette: Huron Mountains, Fortress, NE of Mountain Lake, Sept 1949, *Imshaug 5288*.

Fuscopannaria leucosticta (Tuck.) P. M. Jørg. - corticolous; UP: 1, LP: 0.

Baraga: 5 mi NE of Sidnaw, swamp E of Sturgeon River Campground, on *Thuja*, Sept 1972, *Harris 7976A* (MICH).

Fuscopannaria praetermissa (Nyl.) P. M. Jørg. - terricolous, on calcareous soils; UP: 2, LP: 0.

Ontonagon: Porcupine Mts, on cliff at summit of escarpment above Lake of the Clouds, Sept 1957, *Imshaug 20429*.

Graphis scripta (L.) Ach. - corticolous, on deciduous trees; UP: 11, LP: 25.

Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Betula alleghaniensis*, Oct 1976, *Malachowski 3726*.—Ontonagon: Porcupine Mountains, NW shore of Lake of the Clouds, *Tsuga*, *Acer*, *Betula*, and *Populus* woods, on *Populus tremuloides*, Oct 1976, *Malachowski 5455*.

Gyalecta jenensis (Batsch) Zahlbr. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Keweenaw Point, Copper Harbor, July 1947, *Thomson 3259* (MIN); Isle Royale NP, middle of Passage Island, July 1983, *Wetmore 47452* (MIN).

Gyalecta truncigena (Ach.) Hepp - corticolous, usually on deciduous trees; UP: 5, LP: 2.

Baraga: E of Sturgeon River State Forest Campground, 5 mi NE of Sidnaw, swamp, on *Fraxinus*, Sept 1972, *Harris 7961*.—Charlevoix: E of Pine Grove State Forest Campground, *Thuja* swamp, on *Thuja*, Aug 1972, *Harris 7800*.

Haematomma ochroleucum (Necker) J. R. Laundon - saxicolous, on siliceous rocks, and corticolous; UP: 1, LP: 2.

Gogebic: 2 mi SE of Marenisco, on *Fraxinus*, July 1975, *Harris 10050* (MIN).—Oakland: Proud Lake RA, Proud Lake Bog, on *Larix*, Sept 1975, *Harris 10240* (MIN).

Heterodermia hypoleuca (Muhl.) Trevisan - corticolous, on coniferous and deciduous trees; UP: 2, LP: 2.

Charlevoix: Beaver Island, bluff near Barney Lake, on *Thuja*, Aug 1961, *Imshaug 27740*.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Acer*, Oct 1976, *Malachowski 3692*.

Heterodermia leucomela (L.) Poelt (“*H. leucomelos*”; “*H. leucomelaena*”) - on mossy rocks, trees, and soils; UP: 2, LP: 0.

Alger: Au Train Lake, on down *Thuja* along shore of lake, June 1933, *Lowe 2356* (det. R. C. Harris) (MICH).—Keweenaw: Isle Royale NP (*Wetmore 1997*).

Heterodermia obscurata (Nyl.) Trevisan - corticolous, on deciduous trees; UP: 0, LP: 3.

Clinton: *Quercus* woods on S side of Park Lake, on wood, May 1972, *Harris* 7702.—Iosco: Iargo springs area, 18 mi W of Oscoda, *Thuja-Betula-Picea* swamp, on wood, Sept 1973, *Wang* 539.

Heterodermia speciosa (Wulfen) Trevisan - corticolous, on deciduous trees; UP: 11, LP: 7.

Keweenaw: S of Copper Harbor, Estivant pines, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Betula*, July 1976, *Imshaug* 59110; on NE tip of Belle Isle, in *Populus*, *Abies*, *Betula*, *Picea* woods, on *Populus tremuloides*, June 1977, *Malachowski* 6137A.

Hymenelia epulotica (Ach.) Lutzoni - saxicolous, on calcareous rocks; UP: 2, LP: 1.

Chippewa: Drummond Island, E side of Bass Cove, conifers, along shore, Oct 1976, *Imshaug* 59849.—Emmet: Straits of Mackinac, W of Mackinac City, May 1960, *Imshaug* 25868A.

Hyperphyscia adglutinata (Flörke) H. Mayrh. & Poelt - corticolous, on deciduous trees; UP: 0, LP: 9.

Clare: edge of bog, N of Clare, on *Carya*, Apr 1958, *Imshaug* 21079.—Tuscola: near Caro, on *Populus tremuloides* in open, May 1958, *Imshaug* 21504.

Hypocenomyce friesii (Ach.) P. James & Gotth. Schneider - lignicolous on coniferous trees; UP: 6, LP: 8.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior, with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, on stump, July 1977, *Malachowski* 6380A.—Keweenaw: 2 km S of Eagle Harbor, hardwoods and conifers, on stump, Oct 1976, *Malachowski* 5232B.

Hypocenomyce scalaris (Ach.) M. Choisy - lignicolous, and corticolous on coniferous trees; UP: 8, LP: 17.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, on stump, July 1977, *Malachowski* 6380C.—Keweenaw: Isle Royale NP, along W bank of Siskiwit Creek from Siskiwit Lake to Lake Superior, in *Abies*, *Picea*, *Betula*, and *Thuja*, June 1977, *Malachowski* 5750.

Hypogymnia bitteri (Lynge) Ahti - corticolous, on coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Tobin Harbor, Hidden Lake, on *Thuja*, July 1983, *Wetmore* 49229 (MIN).

Hypogymnia physodes (L.) Nyl. - corticolous, on deciduous and coniferous trees; UP: 15, LP: 31.

Cheboygan: on W side of Hebron Mail Rd, N of Levering Rd, *Thuja* swamp, on *Picea mariana*, Sept 1973, *Wang* 427.—Keweenaw: Isle Royale NP, along W bank of Siskiwit Creek from Siskiwit Lake to Lake Superior, in *Abies*, *Picea*, *Betula*, and *Thuja* forest, on *Betula* stump, June 1977, *Malachowski* 5734A.

Hypogymnia tubulosa (Schaerer) Hav. - usually corticolous, on deciduous and coniferous trees; UP: 9, LP: 4.

Baraga: Point Abbays, low lying *Pinus strobus*, *Betula*, *Fraxinus*, *Acer* forest with standing water, on *Abies*, July 1977, *Malachowski* 6422B.—Keweenaw: on rocky headland of Blueberry Cove, with *Abies*, *Picea*, and *Populus*, on rock, June 1977, *Malachowski* 5910A.

Hypogymnia vittata (Ach.) Parrique - saxicolous, on shaded rocks and terricolous, on open soil; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Hypotrachyna revoluta (Flörke) Hale - corticolous; UP: 2, LP: 0.

Keweenaw: swamp at end of Hay Bay, on *Thuja*, June 1958, *Wetmore* 2537.

Icmadophila ericetorum (L.) Zahlbr. - terricolous, on peat, and corticolous, on decaying wood; UP: 3, LP: 1.

Keweenaw: Isle Royale NP, on E half of Belle Isle, in *Abies*, *Populus*, *Betula*, *Picea* forest, June 1977, *Malachowski* 6174.—Marquette: Huron Mountains, Conway Bay, shore of Lake Superior, on rotting wood, Sept 1949, *Imshaug* 5233.

***Illosporium carneum** Fr. - lichenicolous, on *Peltigera* spp.; UP: 0, LP: 1.

Crawford: N of Higgins Lake, Sept 1962, *Wetmore s.n.* (MIN).

Imshaugia aleurites (Ach.) S. F. Meyer - corticolous, on coniferous trees; UP: 13, LP: 12.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior with *Pinus banksiana* and scattered *Acer*, *Pinus resinosa*, and *P. divaricata*, July 1977, *Malachowski* 6366D.—Chippewa: along shore of Lake Superior, Bayview Campground, in *Acer*, *Betula*, *Pinus banksiana* forest, on *Pinus divaricata*, July 1977, *Malachowski* 7261D.

Imshaugia placorodia (Ach.) S. F. Meyer - corticolous, on coniferous trees; UP: 9, LP: 9.

Baraga: 500 m W of mouth of Huron River, sandy shore of Lake Superior with *Pinus banksiana* and scattered *Acer*, *Pinus resinosa*, and *P. divaricata*, July 1977, *Malachowski* 6369C.—Chippewa: Bayview Campground, along shore of Lake Superior, in *Acer*, *Betula*, *Pinus banksiana* forest, on *Pinus divaricata*, July 1977, *Malachowski* 7261C.

Ionaspis alba Lutzoni - saxicolous, on siliceous rocks; UP: 1, LP: 1.

Delta, Mecosta (Lutzoni 1994).

Ionaspis lacustris (With.) Lutzoni - saxicolous, on inundated siliceous rocks; UP: 1, LP: 1.

Baraga, Cheboygan: (Harris 1977).

Ionaspis lavata H. Magn. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Keweenaw Point, Copper Harbor, July 1947, *Thomson* 2942 (MIN).

Japewia tornoensis (Nyl.) Tønsberg - corticolous, on mossy deciduous trees; UP: 1, LP: 0.

Keweenaw (T. Trana, pers. comm.).

Julella fallaciosa (Arnold) R. C. Harris - corticolous, on deciduous trees; UP: 2, LP: 6.

Chippewa: Drummond Island, along shore N of Bruce Point, in mixed conifer-hardwoods, mostly *Populus*, *Acer*, and *Thuja*, Oct 1976, *Common* 4008A.—Leelanau: woods along Bean Creek at Lime Creek Rd, on *Ulmus*, Apr 1972, *Harris* 7697.

†**Julella lactea** (A. Massal.) R. C. Harris - corticolous, on deciduous trees; UP: 1, LP: 2.

Chippewa: Drummond Island, along shore N of Bruce Point, in mixed conifer-hardwoods, mostly *Populus*, *Acer*, and *Thuja*, on *Fraxinus*, Oct 1976, *Common* 4007E.—Emmet: Wilderness State Park, on *Fraxinus* (?*pennsylvanica*) in swamp, Sept 1965, *Harris* 816.

†**Kirschsteiniothelia aethiops** (Berk. & Curt.) D. Hawksw. (syn. *Microthelia micula*) - corticolous, on smooth bark of deciduous trees; UP: 5, LP: 16.

Charlevoix: Beaver Island, old apple orchard, on *Betula*, Aug 1961, *Imshaug* 27573.—Isabella: N of Mt Pleasant, Woodlot, on *Prunus serotina*, Apr 1958, *Imshaug* 21082.

Lasallia papulosa (Ach.) Llano - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain, N end of Mountain Lake, mostly *Acer*, some *Pinus*, steep rocky hillside, on granite cliff face, Oct 1976, *Malachowski* 3455, 3456.

Lecania cyrtella (Ach.) Th. Fr. - corticolous, on deciduous trees; UP: 0, LP: 1.

Cheboygan: 6 mi SE of Mackinaw City, on *Populus tremuloides*, July 1974, *Wang* 677.

Lecania dubitans (Nyl.) Th. Fr. - corticolous; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, S side of Tonkin Bay, on *Populus tremuloides*, July 1980, *Wetmore* 41331 (MIN); Isle Royale NP, Point Houghton, on *Picea mariana*, July 1983, *Wetmore* 48870 (MIN).

Lecania naegelii (Hepp) Diederich & v. d. Boom - corticolous, on deciduous trees; UP: 3, LP: 19.

Dickinson: N end of O'Neil Lake, moist *Picea-Betula* woods, on *Populus balsamifera*, Sept 1971, *Harris* 7466.—Oscoda: between Watson Rd and Union Corners Rd, 7 mi S of Mio, *Pinus banksiana-Quercus* woods, on *Populus tremuloides*, Sept 1973, *Harris* 8393A.

Lecanora albella (Pers.) Ach. var. **albella** - corticolous, on deciduous trees; UP: 9, LP: 15.

Keweenaw: Isle Royale NP, at end of Tobin Harbor, Aug 1972, *Wetmore* 21185 (MIN).—Leelanau: Sleeping Bear Dunes NL, South Manitou Island, 1 mi SW of Ranger Station, on *Acer saccharum*, July 1987, *Wetmore* 58557 (MIN).

Lecanora albella var. **rubescens** (Imshaug & Brodo) Lumbsch - corticolous; UP: 2, LP: 0.

Dickinson: road into O'Neil Lake Campground, *Pinus banksiana-Populus-Picea* woods, on *Pinus divaricata*, Sept 1971, *Harris* 7493.—Mackinac: Little Brevort Lake, *Fagus-Acer* forest, June 1975, *Imshaug* 58596A.

Lecanora allophana Nyl. - corticolous, on deciduous trees; UP: 8, LP: 9.

Alpena: 8 mi SW of Alpena, off Devil's Lake Rd, on *Populus tremuloides*, Aug 1974, *Wang* 961.—Antrim: 8 mi W of Mancelona, on *Populus tremuloides*, Aug 1974, *Wang* 912.

Lecanora argentata (Ach.) Malme - corticolous, on deciduous trees; UP: 2, LP: 2.

Charlevoix: Beaver Island, Lake Geneserath, on *Acer*, Aug 1961, *Imshaug* 27497.—Ontonagon: Porcupine Mountains, Union River Falls, on *Acer*, Sept 1957, *Imshaug* 20514.

Lecanora caesiorubella Ach. subsp. **caesiorubella** - corticolous, on deciduous trees; UP: 10, LP: 8.

Alger: 2 km N of Little Beaver Lake Campground, *Abies*, *Acer*, and *Betula*, on *Acer*, Oct 1976, *Malachowski* 3180.—Keweenaw: NE end of Schlatter Lake, *Acer*, *Betula*, and *Pinus*, on *Betula alleghaniensis*, Oct 1976, *Malachowski* 4541.

Lecanora caesiorubella subsp. **prolifera** (Fink) R. C. Harris - corticolous; UP: 0, LP: 1.

Roscommon: on *Thuja*, Sept 1959, *Imshaug* 25478 (MIN).

Lecanora caesiorubella subsp. **saximontana** Imshaug & Brodo - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, SW of Saginaw Point, on *Pinus banksiana*, July 1983, *Wetmore* 46968 (MIN); Isle Royale NP, W end Chippewa Harbor, on *Abies balsamea*, July 1983, *Wetmore* 47046 (MIN).

Lecanora carpinea (L.) Vainio - corticolous, on deciduous and coniferous trees; UP: 4, LP: 0.

Marquette: Huron Mountains, N end of Mountain Lake, mostly *Acer*, some *Pinus*, steep rocky hillside, on *Acer*, Oct 1976, *Malachowski* 3423.—Ontonagon: NE of Buckshot Cabin along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Abies*, Oct 1976, *Malachowski* 5573.

Lecanora cateilea (Ach.) A. Massal. - corticolous, on coniferous trees; UP: 2, LP: 0.

Marquette: Huron Mountains, 3 km NW of Howe Lake along Lake Superior shore, *Abies balsamea*, *Tsuga*, *Betula*, and *Acer*, on *Abies*, Oct 1976, *Malachowski* 3953.

Lecanora cenisia Ach. - saxicolous, on siliceous rocks; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, on rock, Aug 1972, *Thomson* 72323 (MIN); Isle Royale NP, SE of Lookout Louise, July 1983, *Wetmore* 46918 (MIN).

Lecanora chlarotera Nyl. - corticolous, on deciduous and coniferous trees; UP: 7, LP: 9.

Mason: Big Sable Point near Ludington, between Lake Michigan and Hamlin Lake, forested dunes, on *Quercus*, June 1957, *Imshaug* 19702.—Presque Isle: Lake Huron, Presque Isle Point, between North Bay and Presque Isle Harbor, low, unstable dune, on dead *Picea*, June 1958, *Imshaug* 22157.

Lecanora chlorophaeodes Nyl. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Lecanora cinereofusca H. Magn. - corticolous, on deciduous trees; UP: 2, LP: 2.

Chippewa: Lower Tahquamenon Falls, *Fagus-Acer* forest, Aug 1957, *Imshaug* 19928.

Lecanora circumborealis Brodo & Vitik - corticolous, on deciduous and coniferous trees; UP: 4, LP: 2.

Houghton: along Lake Superior near Calumnet, forested sand dunes, on *Quercus*, Sept 1957, *Imshaug* 20858.—Luce: along Lake Superior, near Deer Park, *Betula* trees on low sand dunes, on *Betula*, Aug 1957, *Imshaug* 20334.

Lecanora conizaeoides Nyl. ex Crombie - corticolous, on deciduous and coniferous trees; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Lecanora crenulata Hook. - saxicolous, on calcareous rocks; UP: 3, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Lecanora dispersa (Pers.) Sommerf. - saxicolous, on calcareous rocks; UP: 4, LP: 7.

Ingham: MSU campus, East Lansing, grassy field between Plant Biology and railroad tracks, June 1974, *Harris* 8705.—Presque Isle: Ocqueoc Falls, NE of Onaway, July 1974, *Harris* 9066.

Lecanora expallens Ach. - corticolous, on coniferous and deciduous trees; UP: 4, LP: 7.

Mason: Big Sable Point, Ludington, between Lake Michigan and Hamlin Lake, forested dunes, on *Quercus*, June 1957, *Imshaug* 19696.—Schoolcraft: National Forest, Munising, 1.9 mi N of S boundary of Nat. Forest between Manistique and Munising, on *Quercus*, Aug 1957, *Imshaug* 20156.

Lecanora fuscescens (Sommerf.) Nyl. - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecanora garovaglii (Körber) Zahlbr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecanora glabrata (Ach.) Malme - corticolous, on deciduous trees; UP: 4, LP: 4.

Charlevoix: Beaver Island, Lake Geneserath, on *Acer*, Aug 1961, *Imshaug* 27506.—Mackinac: N of Hessel, hardwoods, on *Fagus*, Aug 1949, *Imshaug* 3937.

Lecanora hagenii (Ach.) Ach. - corticolous; UP: 4, LP: 1.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, Oct 1971, *Harris* 7670.—Keweenaw: Isle Royale NP, Point Houghton, on *Thuja*, July 1983, *Wetmore* 48815 (MIN).

Lecanora hybocarpa (Tuck.) Brodo - corticolous; UP: 4, LP: 6.

Benzie: Sleeping Bear Dunes NL, Platte Point, on *Quercus rubra*, June 1987, *Wetmore* 58081 (MIN).—Keweenaw: Isle Royale NP, N of Robinson Bay, on *Thuja*, July 1983, *Wetmore* 49746 (MIN).

Lecanora impudens Degel. - corticolous, on deciduous trees; UP: 6, LP: 11.

Keweenaw: Wilderness Rd S of Copper Harbor, swamp with dead *Thuja* trees and *Typha*, July 1976, *Imshaug* 58897.—Newaygo: along roadside, on *Quercus alba*, Apr 1958, *Imshaug* 21200.

Lecanora imshaugii Brodo - corticolous, on deciduous trees; UP: 2, LP: 2.

Mackinac: Bois Blanc Island, on *Acer saccharum*, Aug 1945, *Wagner* 466 (MIN).

Lecanora intricata (Ach.) Ach. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore* 47263 (MIN); Isle Royale NP, W End of Minong Ridge Trail, July 1984, *Wetmore* 52425 (MIN).

Lecanora meridionalis H. Magn. - corticolous, on coniferous trees; UP: 3, LP: 5.

Benzie: Sleeping Bear Dunes NL, Little Platte Lake, on *Pinus strobus*, June 1987, *Wetmore* 58027 (MIN).—Keweenaw: Isle Royale NP, South Government Island, on *Thuja*, July 1984, *Wetmore* 53257 (MIN).

Lecanora muralis (Schreber) Rabenh. - saxicolous, on siliceous and calcareous rocks; UP: 6, LP: 1.

Chippewa: Drummond Island, Bruce Point, along shore in mixed conifer-hardwoods, Oct 1976, *Imshaug 60021*; Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug 60130*.

Lecanora opiniconensis Brodo - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore 47222* (MIN); Isle Royale NP, Amygdaloid Island, July 1984, *Wetmore 51551* (MIN).

Lecanora piniperda Körber - corticolous; UP: 3, LP: 3.

Keweenaw: Isle Royale NP, inside Chippewa Harbor, on *Betula* log, July 1983, *Wetmore 47123* (MIN); Isle Royale NP, 1 mi S of Huginnin Cove, on *Thuja* snag, July 1984, *Wetmore 52801* (MIN).

Lecanora polytropa (Hoffm.) Rabenh. - saxicolous, on siliceous rocks; UP: 9, LP: 8.

Alger: NE of Kingston Lake, open fields, Sept 1970, *Harris 6013*.—Chippewa: Sugar Island, shore of Duck Lake, July 1967, *Harris 3688*.

Lecanora pseudistera Nyl. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Alger (Harris 1977).

Lecanora pulicaris (Pers.) Ach. - corticolous, on coniferous trees; UP: 11, LP: 12.

Leelanau: near Houdek Creek at N end of Lake Leelanau, *Thuja* bog, on *Abies*, June 1957, *Imshaug 19544*.—Schoolcraft: between Manistique and Munising, open woods of *Pinus banksiana* with *Quercus*, on *Pinus divaricata*, Aug 1957, *Imshaug 20165*.

Lecanora rugosella Zahlbr. - corticolous; UP: 10, LP: 12.

Mackinac: NW of Cedarville, conifer woods, on *Abies*, Aug 1949, *Imshaug 3693*.—Marquette: W side of the Huron Mountains, near Cliff Lake, on *Acer*, Sept 1949, *Imshaug 4320*.

Lecanora rupicola (L.) Zahlbr. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Eagle River, Cliff Mine, Aug 1972, *Wetmore 20918* (MIN); Isle Royale NP, mouth of McCargo Cove, July 1983, *Wetmore 48024* (MIN).

Lecanora saligna (Schrader) Zahlbr. - lignicolous; UP: 2, LP: 4.

Ingham: MSU Campus, SW corner of Baker Woodlot, on *Cephalanthus* in pond, Feb 1974, *Harris 8618*.—Jackson: Sharonville State Game Area, E of Fishville Rd, dry fields, on old wood, June 1970, *Harris 5949*.

Lecanora sambuci (Pers.) Nyl. - corticolous, on deciduous trees; UP: 6, LP: 28.

Alpena: 8 mi SW of Alpena, off Devil's Lake Rd, on *Populus tremuloides*, Aug 1974, *Wang 962*.—Cheboygan: 6 mi SE of Mackinaw City, on *Populus tremuloides*, July 1974, *Wang 678*.

Lecanora strobilina (Sprengel) Kieffer - corticolous, on coniferous and deciduous trees; UP: 4, LP: 4.

Keweenaw: Isle Royale NP, Capt. Kidd Island, July 1959, *Wetmore 4701* (MIN).—Leelanau: Sleeping Bear Dunes NL, South Manitou Island, 1 mi SW of Ranger Station, on *Populus tremuloides*, July 1987, *Wetmore 58536* (MIN).

Lecanora subrugosa Nyl. - corticolous; UP: 5, LP: 2.

Gogebic: Lake Gogebic, mixed hardwoods-conifer forest, Sept 1957, *Imshaug 20560*.—Oscoda: along E branch of Big Creek, downstream from Mapes Rd, on *Thuja*, Sept 1973, *Harris 8282*.

Lecanora symmicta (Ach.) Ach. - lignicolous and corticolous; UP: 12, LP: 30.

Alger: 1 km E of Hurricane River Campground along shore of Lake Superior, *Abies*, *Betula alleghaniensis*, *Acer* and *Thuja* wood, on *Abies*, Oct 1976, *Malachowski* 2676.—Marquette: Huron Mountains, 3 km NW of Howe Lake along Lake Superior shore, *Betula alleghaniensis*, *Abies balsamea*, *Tsuga*, *Betula*, and *Acer* woods, on *Betula alleghaniensis*, Oct 1976, *Malachowski* 3962.

Lecanora thysanophora R. C. Harris – corticolous, on deciduous and coniferous trees; UP:7, LP:8.

Marquette: Huron Mountains, Mt. Ida, west side of Lake Ann, *Acer*, *Betula*, *Pinus*, and *Thuja* woodland, on *Acer*, Oct 1976, *Malachowski* 4128.—Ontonagon: Misery Bay, near mouth of Little Misery River, hardwoods and conifers, Oct 1976, *Malachowski* 5386.

Lecanora varia (Hoffm.) Ach. - lignicolous and corticolous, on deciduous trees; UP: 1, LP: 1.

Charlevoix: Lake Charlevoix, 1923, *Darlington* 234.

Lecanora wisconsinensis H. Magn. - corticolous; UP: 8, LP: 5.

Charlevoix: Beaver Island, North End Bay, on *Populus*, Aug 1961, *Imshaug* 27530.—Leelanau: near Houdek Creek at N end of Lake Leelanau, *Thuja* bog, on *Larix*, June 1957, *Imshaug* 19518.

Lecidea albofuscescens Nyl. - corticolous, on coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, South Government Island, on base of *Abies balsamea*, July 1980, *Wetmore* 41026 (MIN).

Lecidea atrobrunnea (Ramond ex Lam. & DC.) Schaerer. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore* 21291 (MIN); Isle Royale NP, Edwards Island, July 1983, *Wetmore* 48501 (MIN).

Lecidea carnulenta (Tuck.) Fink. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecidea cyrtidia Tuck. - saxicolous, on siliceous rocks and pebbles; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecidea erythrophaea Vainio - corticolous, on deciduous trees; UP: 4, LP: 4.

Cheboygan: in gorge of Carp Creek, Univ. of Mich. Biological Station W of Pellston, moist woods, on *Acer saccharum*, July 1967, *Harris* 3654.—Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Fraxinus*, Oct 1968, *Harris* 3916.

Lecidea fuscoatra (L.) Ach. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, Aug 1972, *Wetmore* 21165 (MIN); Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore* 47253 (MIN).

Lecidea lapicida (Ach.) Ach. var. **lapicida** - saxicolous, on siliceous rocks; UP: 1, LP: 1.

Gogebic: Porcupine Mts, 1923, *Darlington* s.n.

Lecidea lapicida var. **pantherina** Ach. (syn. *L. lapicida* p.p., *L. lactea*) - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecidea lithophila (Ach.) Ach. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecidea lurida (Ach.) DC. - terricolous, on calcareous soils; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Lecidea nylanderi (Anzi) Th. Fr. - corticolous, on coniferous trees; UP: 2, LP: 3.

Dickinson: road into O'Neil Lake Campground, *Picea-Pinus banksiana-Populus* woods, on *Pinus divaricata*, Sept 1971, *Harris 7547*.—Oscoda: near Wagner Lake, about 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, on *Pinus divaricata*, Sept 1973, *Harris 8196*.

Lecidea plana (J. Lahm) Nyl. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Alger: NE of Kingston Lake, Sept 1970, *Harris 6042* (MIN).—Keweenaw: Isle Royale NP, S side of Tonkin Bay, July 1980, *Wetmore 41327* (MIN).

Lecidea plebeja Nyl. - corticolous, on coniferous trees; UP: 4, LP: 0.

Alger: open fields NE of Kingston Lake, on stump, Sept 1970, *Harris 6038*.—Dickinson: road into O'Neil Lake Campground, *Pinus banksiana-Populus-Picea* woods, on stump, Sept 1971, *Harris 7486*.

Lecidea tessellata Flörke - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Keweenaw Point, E end of Agate Harbor, July 1947, *Thomson 3341* (MIN); Isle Royale NP, West Caribou Island, July 1983, *Wetmore 46717* (MIN).

Lecidella asema (Nyl.) Knoph & Hertel - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore 41373* (MIN).

Lecidella carpathica Körber - saxicolous, on calcareous and siliceous rocks; UP: 1, LP: 0.

Keweenaw: Eagle River, Cliff Mine, Aug 1972, *Wetmore 20882* (MIN); Isle Royale NP, SW of Saginaw Point, July 1983, *Wetmore 46941* (MIN).

Lecidella elaeochroma (Ach.) M. Choisy - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Lane Cove, on *Thuja*, July 1983, *Wetmore 46774* (MIN); Isle Royale NP, little NE Point of Todd Harbor, on *Thuja*, July 1984, *Wetmore 53147* (MIN).

Lecidella euphorea (Flörke) Hertel - corticolous, on deciduous trees; UP: 3, LP: 1.

Baraga: about 0.25 mi N of Sturgeon River Campground, 5 mi NE of Sidnaw, *Populus* woods, on *Populus grandidentata*, Sept 1972, *Harris 8157*.—Leelanau: Sleeping Bear Dunes NL, Good Harbor Bay, Good Harbour CR, on *Populus balsamifera*, July 1987, *Wetmore 58660* (MIN).

Lecidella patavina (A. Massal.) Knoph & Leuckert - saxicolous, on calcareous and siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S side of Davidson Island, Aug 1972, *Nash 5643* (ASU) (Knoph & Leuckert 1994).

Lecidella stigmathea (Ach.) Hertel & Leuckert - saxicolous, on calcareous and siliceous rocks; UP: 6, LP: 1.

Cheboygan: around Vincent Lake, *Quercus-Populus* woods, June 1967, *Harris 3627*.—Mackinac: W of Hessel on Michigan Hwy 134, Lake Huron shore, Sept 1966, *Harris 1083A*.

Lepraria caesioalba (de Lesd.) J. R. Laundon - saxicolous, on exposed siliceous rocks; UP: 4, LP: 8.

Keweenaw: Isle Royale NP, Daisy Farm Trail to Greenstone, June 1965, *Erbisch 1246* (MIN); 5 mi SSE of Copper Harbor, July 1968, *Erbisch 2570* (MIN).

Lepraria eburnea J. R. Laundon - shaded, mossy rocks, trees, and soil; UP: 2, LP: 4.

Chippewa: Detour State Park, moist conifer woods, on *Thuja*, Aug 1974, *Harris 9479* (MICH).—Oscoda: Wagner Lake, ca. 7 mi S of Mio, on soil bank in shade, May 1975, *Harris, 9826*.

Lepraria incana (L.) Ach. - saxicolous, on shaded siliceous rocks, and corticolous; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Lepraria lobificans Nyl. - saxicolous, on shaded siliceous rocks, and corticolous; UP: 7, LP: 13.

Clinton: *Thuja* swamp S of Stoll Rd, N of Potter Lake, on rotten stump, Nov 1973, *Harris 8484*.—Ingham: MSU campus, East Lansing, Baker Woodlot, near middle of Baker natural area, on *Acer saccharum*, Nov 1973, *Harris 8611*.

Lepraria neglecta (Nyl.) Erichsen - saxicolous, on exposed siliceous rocks; UP: 2, LP: 0.

Chippewa: Drummond Island, Maxton Plains, in crack on dolostone pavement, May 1981, *Marr 872* (MIN).—Keweenaw: Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore 47247* (MIN).

Leptroloma membranaceum (Dickson) Vainio - on shaded siliceous rocks and trees; UP: 2, LP: 1.

Ontonagon: Porcupine Mts, on *Tsuga*, 1922, *Darlington s.n.*

Leptroloma vouauxii (Hue) J. R. Laundon - saxicolous, on shaded calcareous and siliceous rocks, and corticolous; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Leptogium arsenei Sierk. - saxicolous, on mossy rocks, and corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, New Feldtman Tower, N slope, on *Thuja*, July 1983, *Wetmore 48586* (MIN); Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49581* (MIN).

Leptogium burnetiae C. W. Dodge - corticolous, on deciduous trees; UP: 4, LP: 0.

Baraga: along Sturgeon River about 0.25 mi N of campground, 5 mi NE of Sidnaw, moist woods, on *Fraxinus*, Sept 1972, *Harris 8109*.—Keweenaw: Isle Royale NP, Wallace Lake, on *Populus tremuloides*, July 1983, *Wetmore 47609* (MIN).

Leptogium corticola (Taylor) Tuck. - on trees and logs; UP: 1, LP: 3.

Cheboygan: gorge of Carp Creek, with *Porella*, *Neckera*, on bark of fallen tree, July 1967, *Engel 903*.—Keweenaw: Isle Royale NP, New Feldtman Tower, S slope, on *Populus tremuloides*, July 1983, *Wetmore 48719* (MIN).

Leptogium cyanescens (Rabenh.) Körber - corticolous, on mossy trees; UP: 12, LP: 8.

Marquette: Huron Mountains, "Flat Rock," along Lake Superior shore, *Abies balsamea*, *Betula*, scattered *Pinus strobus*, on *Thuja*, Oct 1976, *Malachowski 3837*.—Ontonagon: Porcupine Mountains, NW shore of Lake of the Clouds, *Tsuga*, *Acer*, *Betula*, and *Populus* woods, on *Acer*, Oct 1976, *Malachowski 5444*.

Leptogium gelatinosum (With.) J. R. Laundon - on mossy rocks and trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, West Caribou Island, July 1983, *Wetmore 46720B* (MIN).

Leptogium lichenoides (L.) Zahlbr. - on mossy rocks and trees; UP: 5, LP: 5.

Chippewa: W of Detour, shore of Lake Huron, on rock, Aug 1949, *Imshaug 4065*.—Mackinac: E of Cedarville, shore of Lake Huron, on rock, Aug 1949, *Imshaug 3969*.

Leptogium milligranum Sierk. - corticolous, on deciduous trees; UP: 1, LP: 0.

Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Acer*, Oct 1976, *Malachowski 3694B*.

Leptogium plicatile (Ach.) Leighton - saxicolous, on semi-inundated rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Leptogium pseudofurfuraceum P. M. Jørg. (syn. *L. furfuraceum*) - saxicolous, on mossy rocks, and corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S shore of Grace Harbor, on *Populus tremuloides*, July 1984, *Wetmore 51795* (MIN); Isle Royale NP, SE of Grace Creek Bog, on fallen *Populus tremuloides*, July 1984, *Wetmore 52126* (MIN).

Leptogium saturninum (Dickson) Nyl. - corticolous, on deciduous trees; UP: 6, LP: 1.

Dickinson: NNW of Ralph, *Acer* woods S of McGregor Creek, on *Acer saccharum*, Sept 1971, *Harris 7586*.—Keweenaw: Isle Royale NP, SW point of Brady Cove, in *Populus*, *Betula*, *Abies* forest, on *Populus tremuloides*, June 1977, *Malachowski 6208A*.

Leptogium tenuissimum (Dickson) Körber - on mossy calcareous soils and trees; UP: 3, LP: 2.

Cheboygan: The Gorge, on *Ulmus*, July 1949, *Imshaug 3142*; W end of Reese's Bog, near shore of Burt Lake, on *Thuja*, July 1949, *Imshaug 3183*.

Leptorhaphis atomaria (Ach.) Szat. - corticolous, on deciduous trees; UP: 4, LP: 2.

Iosco: around Corsair State Forest Campground, *Pinus banksiana*-*Populus* woods, on *Populus tremuloides*, Sept 1965, *Harris 820*.—Iron: junction County Rd 657 and USF Hwy 139, in *Pinus banksiana*-*Populus* woods, on *Populus tremuloides*, Sept 1965, *Harris 721*.

†**Leptorhaphis contorta** Degel. - corticolous, on deciduous trees; UP: 6, LP: 10.

Dickinson: road into O'Neil Lake Campground, *Pinus banksiana*-*Populus*-*Picea* woods, on *Populus tremuloides*, Sept 1971, *Harris 7474*.—Iron: junction County Rd 657 and USF Hwy 139, in *Pinus banksiana*-*Populus* woods, on *Populus tremuloides*, Sept 1965, *Harris 719*.

†**Leptorhaphis epidermidis** (Ach.) Th. Fr. - corticolous, on deciduous trees; UP: 6, LP: 7.

Alger: N of Kingston Lake, open fields and woods, on *Betula papyrifera*, Sept 1965, *Harris 626*.—Ontonagon: Porcupine Mountains, just E of parking lot, Lake of the Clouds, in woods, on *Betula papyrifera*, Sept 1965, *Harris 688*.

†**Leptorhaphis parmeca** (A. Massal.) Körber - corticolous, on deciduous trees; UP: 1, LP: 3.

Alger: N of Kingston Lake, in open fields and woods, on *Prunus*, Sept 1965, *Harris* 623.—Roscommon: 6 mi S of Prudenville, on *Populus tremuloides*, July 1974, *Wang* 782.

Lichinella nigritella (Lettau) Moreno & Egea - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore* 21362B (MIN); Isle Royale NP, Net Island, NE of Amygdaloid Island, July 1984, *Wetmore* 51446 (MIN).

Lithothelium hyalosporum (Nyl.) Aptroot - corticolous, on deciduous trees; UP: 9, LP: 11.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Betula alleghaniensis*, Sept 1972, *Harris* 7991.—Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Betula lutea*, Oct 1968, *Harris* 3928.

Lithothelium macrosporum (R. C. Harris) Aptroot - corticolous, on deciduous trees; UP: 3, LP: 3.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus americana*, Oct 1968, *Harris* 3927B.

Lithothelium phaeosporum (R. C. Harris) Aptroot - corticolous, on deciduous trees; UP: 3, LP: 3.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Fraxinus*, Sept 1972, *Harris* 7986.—Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on dead *Ulmus americana*, Oct 1968, *Harris* 3927A.

Lithothelium septemseptatum (R. C. Harris) Aptroot - corticolous, on deciduous trees; UP: 3, LP: 9.

Cass: Russ Forest, 7 mi S of Decatur, moist woods, on *Acer*, May 1970, *Harris* 5879C.—Delta: NW of Isabella, on USFS 2231, 1.8 mi W of USFS 2226, swamp, on *Fraxinus*, Sept 1969, *Harris* 4257.

Lobaria pulmonaria (L.) Hoffm. - corticolous, on mossy deciduous trees; UP: 13, LP: 13.

Chippewa: Drummond Island, E side of Bass Cove, on *Populus*, Oct 1976, *Imshaug* 59897.—Keweenaw: Wilderness Rd (Mandam Rd), S of Copper Harbor, mixed hardwood-conifer forest, on *Acer*, July 1976, *Imshaug* 58886.

Lobaria quercizans Michaux - corticolous, on mossy deciduous trees; UP: 13, LP: 16.

Chippewa: Drummond Island, S of Beaver Pond, *Fagus-Acer* forest, on *Acer*, Oct 1976, *Imshaug* 59918.—Keweenaw: Isle Royale NP, E of Hay Bay Campground, in *Abies*, *Betula*, *Taxus*, *Populus* forest, June 1977, *Malachowski* 5856H.

Lobaria scrobiculata (Scop.) DC. - corticolous and saxicolous, on mossy deciduous trees and rocks; UP: 1, LP: 0.

Keweenaw: Wilderness Rd (Mandam Rd), S of Copper Harbor, swamp with dead *Thuja* trees and *Typha*, July 1976, *Imshaug* 58902; Isle Royale NP, along Siskiwit Falls River from Siskiwit Lake to Malone Bay, over rock, June 1958, *Wetmore* 2400.

Lobothallia alphoplaca (Wahlenb.) Hafellner - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Keweenaw Point, near Hebard Park, July 1947, *Thomson 3329* (MIN); Isle Royale NP, Edwards Island, July 1983, *Wetmore 48491* (MIN).

Lopadium disciforme (Flotow) Kullh. - corticolous, on mossy trees; UP: 7, LP: 1.

Keweenaw: High Rock Bay, Lake Superior shore, *Abies balsamea*, *Betula*, and *Pinus strobus*, *Thuja*, Oct 1976, *Malachowski 4634*; Isle Royale NP, Brady Cove, on SW point of Brady Cove, in *Populus*, *Betula*, *Abies* forest, on *Thuja*, June 1977, *Malachowski 6206C*.

Loxospora cismonica (Beltr.) Hafellner- corticolous, on coniferous trees; UP: 3, LP: 1.

Ontonagon: S of Rockland, between Mich Hwy 45 and E. branch of Ontonagon River, Sept 1964, *Harris s.n.*

Loxospora elatina (Ach.) A. Massal. - corticolous, on coniferous and deciduous trees; UP: 11, LP: 4.

Chippewa: Drummond Island, E side of Bass Cove, on *Thuja*, Oct 1976, *Imshaug 59896*.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Tsuga*, Oct 1976, *Malachowski 3613*.

Loxospora ochrophaea (Tuck.) R. C. Harris - corticolous, on coniferous trees; UP: 4, LP: 4.

Cheboygan: Reese's Bog, along Burt Lake, on *Thuja*, June 1974, *Harris 8737*.—Oscoda: downstream from Mapes Rd (County Rd 487) along E branch of Big Creek, *Thuja-Picea* swamp, on *Thuja*, Sept 1973, *Harris 8300*.

Loxospora pustulata (Brodo & Culb.) R. C. Harris - corticolous; UP: 5, LP: 2.

Leelanau: Sleeping Bear Dunes NL, N end of North Bar Lake, on *Fraxinus nigra*, July 1987, *Wetmore 58141* (MIN).—Marquette: Huron Mountains, along Lake Superior shore, "Flat Rock," *Abies balsamea*, *Betula*, scattered *Pinus strobus*, on *Thuja*, Oct 1976, *Malachowski 3851*.

Massalongia carnosa (Dickson) Körber - damp, mossy rocks; UP: 1, LP: 0.

Marquette: hill at W end of Huron Mountains, Sept 1949, *Imshaug 4705* (MICH) (det. P. M. Jørgensen).

Megalaria laureri (Th. Fr.) Hafellner - corticolous, on deciduous trees; UP: 2, LP: 0.

Luce: Upper Tahquamenon Falls, in *Fagus-Acer* forest, on *Acer*, Aug 1957, *Imshaug 19889*.—Mackinac: in hardwood forests N of Hessel, on *Fagus*, Aug 1949, *Imshaug 3931*.

Megalospora porphyritis (Tuck.) R. C. Harris - corticolous; UP: 2, LP: 1.

Delta: Charboneau Point, on *Thuja*, Sept 1976, *Harris 11782* (MIN).

Megaspora verrucosa (Ach.) Hafellner & V. Wirth - terricolous, on calcareous soils, and corticolous, on deciduous trees; UP: 3, LP: 1.

Leelanau: Sleeping Bear Dunes NL, S shore of Glen Lake, on *Acer saccharum*, July 1987, *Wetmore 58197* (MIN).—Ontonagon: NE of Buckshot Cabin along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Populus tremuloides*, Oct 1976, *Malachowski 5556*.

Melanelia albertana (Ahti) Essl. - corticolous, on deciduous trees; UP: 1, LP: 0.

Cheboygan: on *Populus* (Harris 1977).

Melanelia disjuncta (Erichsen) Essl. - saxicolous, on siliceous rocks; UP: 3, LP: 0.

Keweenaw: along shore of Blakes Point, in *Thuja*, *Abies*, *Betula* forest, on rock, June 1977, *Malachowski 6031C*.—Marquette: Huron Mountain, N end of Mountain Lake, steep rocky hillside with mostly *Acer*, some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3496*.

Melanelia elegantula (Zahlbr.) Essl. - corticolous, on deciduous trees; UP: 1, LP: 0.

Marquette: Huron Mountains, Fortress, NE of Mountain Lake, Sept 1949, *Imshaug 5318* (MICH).

Melanelia exasperata (De Not.) Essl. - corticolous, on deciduous trees; UP: 3, LP: 1.

Marquette: Huron Mountain, N end of Mountain Lake, mostly *Acer*, some *Pinus*, on steep rocky hillside, on *Acer*, Oct 1976, *Malachowski 3393*.—Ontonagon: Porcupine Mountains, along summit of escarpment above Lake of the Clouds, on *Quercus*, Sept 1957, *Imshaug 20440*.

Melanelia exasperatula (Nyl.) Essl. - corticolous, on deciduous trees; UP: 5, LP: 3.

Keweenaw: Eagle Harbor, 2 km S of Eagle Harbor, hardwoods and conifers, on *Populus tremuloides*, Oct 1976, *Malachowski 5302*; Isle Royale NP, on NE tip of Belle Isle, *Populus*, *Abies*, *Betula*, *Picea* woods, on *Populus tremuloides*, June 1977, *Malachowski 6144A*.

Melanelia fuliginosa (Fr. ex Duby) Essl. - corticolous, on deciduous trees, and saxicolous, on siliceous rocks; UP: 5, LP: 3.

Charlevoix: Beaver Island, Protars Tomb, on *Acer*, Aug 1961, *Imshaug 27471*.—Marquette: Huron Mountain, N end of Mountain Lake, steep rocky hillside with mostly *Acer*, some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3495*.

Melanelia hepatizon (Ach.) Thell - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, at Jackpine Point about halfway down bay on N side between Conglomerate Bay and Tonkin Bay, on rock, July 1959, *Wetmore 4288*; Isle Royale NP, rock cliffs back from shore on main island across from Clay Island, in bay S of Robinson Bay, on rock cliffs, July 1959, *Wetmore 4540*.

Melanelia infumata (Nyl.) Essl. - saxicolous, on calcareous and siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, at SW end of Washington Island, on rock, June 1958, *Wetmore 2134*; Isle Royale NP, on main island across from Clay Island, in bay S of Robinson Bay, on rock, July 1959, *Wetmore 4529*.

Melanelia olivacea (L.) Essl. - corticolous, on deciduous trees; UP: 12, LP: 3.

Baraga: Sturgeon River Campground, 5 mi NE of Sidnaw, on *Acer rubrum*, Sept 1972, *Harris 8118*.—Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug 58986*.

Melanelia panniformis (Nyl.) Essl. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Marquette: Huron Mountain, N end of Mountain Lake, steep rocky hillside with mostly *Acer* and some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3513*.

Melanelia septentrionalis (Lynge) Essl. - corticolous; UP: 13, LP: 5.

Cheboygan: N side of Potter Rd, N of Dingman Marsh flooding, 5 mi SE of Mackinac City, *Thuja* swamp, on dying *Thuja*, June 1973, *Wang 177*.—Keweenaw: N end of Deer Lake, on *Abies*, July 1976, *Imshaug 58817*.

Melanelia sorediata (Ach.) Goward & Ahti - saxicolous, on siliceous rocks; UP: 8, LP: 1.

Baraga: 0.5 mi N of Sturgeon River Campground, 5 mi NE of Sidnaw, in *Populus* woods, Sept 1972, *Harris 8150B*.—Keweenaw: High Rock Bay along Lake Superior shore, on rock, Oct 1976, *Malachowski 4766*.

Melanelia subargentifera (Nyl.) Essl. - corticolous, on deciduous trees; UP: 5, LP: 1.

Marquette: Huron Mts, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Acer*, Oct 1976, *Malachowski 3633*.—Ontonagon: NE of Buckshot Cabin along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Populus*, Oct 1976, *Malachowski 5548*.

Melanelia subaurifera (Nyl.) Essl. - corticolous, on deciduous trees; UP: 15, LP: 44.

Alger: 500 m S of Twelve-Mile Beach Campground, *Pinus strobus*, *Pinus banksiana*, *Abies balsamea*, and *Betula*, on *Betula papyrifera*, Oct 1976, *Malachowski 2740*.—Baraga: Point Abbays, low lying *Pinus strobus*, *Betula*, *Fraxinus*, *Acer* forest with standing water, on *Fraxinus*, July 1977, *Malachowski 6419D*.

Melanelia subolivacea (Nyl.) Essl. - corticolous, on deciduous trees; UP: 2, LP: 1.

Alger: Pictured Rocks NL, 1 mi NE of Twelve-Mile Beach Campground, on *Acer saccharum*, July 1987, *Wetmore 59009* (MIN).—Keweenaw: Eagle River, Cliff Mine, on *Quercus*, Aug 1972, *Wetmore 20925* (MIN).

Melanelia tominii (Oksner) Essl. - corticolous, on deciduous trees, and saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, open exposed area on S side of Davidson Island, on rock, Aug 1972, *Nash 5631*; Isle Royale NP, Lake Superior side of Mott Island, June 1957, *Wetmore 236C*.

Melanelia trabeculata, (Ahti) Essl. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, woods on NE tip of Belle Isle, in *Populus*, *Abies*, *Betula*, *Picea* woods, on *Populus tremuloides*, June 1977, *Malachowski 6149A*; Isle Royale NP, N of Robinson Bay, on *Populus tremuloides*, July 1983, *Wetmore 49732* (MIN).

Melaspilea arthonioides (Fée) Nyl. - corticolous, on deciduous trees; UP: 1, LP: 0.

Alger: Pictured Rocks NL (*Wetmore 1997*).

Melaspilea deformis, (Schaerer) Nyl. - corticolous, on deciduous trees; UP: 0, LP: 1.

Alpena: 8 mi SW of Alpena, off Devil's Lake road, on *Populus tremuloides*, Aug 1974, *Wang 964*.

Menegazzia terebrata (Hoffm.) A. Massal. - corticolous; UP: 7, LP: 5.

Cheboygan: S side of Hebron Mail Rd, 1 mi N of Levering Rd, *Thuja* swamp, on dead limb of *Thuja*, June 1973, *Wang 262*.—Dickinson: at S end of O'Neil Lake, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, *Harris 7415*.

Micarea bauschiana (Körber) V. Wirth & Vezda - saxicolous, on siliceous rocks; UP: 0, LP: 2.

Emmet: non-calcareous rocks (*Harris 1977*).

Micarea denigrata (Fr.) Hedl. - corticolous and lignicolous; UP: 1, LP: 0.

Alger: Pictured Rocks NL, 0.5 mi SSW of Miners Castle Point, on *Acer*, July 1987, *Wetmore 59588* (MIN).

Micarea endocyanea (Tuck. ex Willey) R. C. Harris - on rotting wood and conifer bark; UP: 1, LP: 2.

Cheboygan and Presque Isle: on rotting wood and conifer bark (Harris 1977).

Micarea erratica (Körber) Hertel, Rambold & Pietschmann - saxicolous, on siliceous rocks; UP: 5, LP: 11.

Oscoda: near Wagner Lake, about 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, Sept 1973, *Harris* 8207, 8258.

Micarea lignaria (Ach.) Hedl. - on mossy rocks and trees; UP: 1, LP: 0.

Keweenaw: Dow Wilderness Area, on *Abies*, Sept 1976, *Erbisch* 4440 (MIN).

Micarea melaena (Nyl.) Hedl. - on decaying wood; UP: 7, LP: 2.

Cheboygan: S of Hebron Mail Rd, 2 mi N of Levering Rd, *Thuja* swamp, on burned stump, Sept 1973, *Wang* 361.—Delta: near Camp 7 Lake NW of Isabella, *Pinus banksiana* woods, on burnt stump, Sept 1969, *Harris* 4047.

Micarea melanobola (Nyl.) Coppins - on old wood; UP: 1, LP: 0.

Mackinac: along Crow Lake Trail, ca. 2.5 mi from Big Knob Campground, *Pinus banksiana-Populus* woods, on stump, May 1977, *Harris* 12428 (MICH).

Micarea misella (Nyl.) Hedl. - on decaying wood; UP: 0, LP: 1.

Cheboygan: on wood (Harris 1977).

Micarea peliocarpa (Anzi) Coppins & R. Sant. - corticolous and lignicolous; UP: 4, LP: 3.

Keweenaw: Isle Royale NP, Middle Point SE of Washington Island, on *Thuja* log, July 1984, *Wetmore* 51730 (MIN).—Roscommon: in *Thuja* swamp, Sept 1959, *Imshaug* 25498.

Micarea prasina Fr. - usually corticolous on mossy trees, or terricolous; UP: 2, LP: 6.

Oscoda: E. branch of Big Creek from Mapes Rd, *Thuja-Picea* swamp, on conifer bark, Sept 1973, *Harris* 8284.—Presque Isle: near Shoepac Lake, *Pinus banksiana* woods, on sandy soil near mosses, July 1967, *Harris* 3682.

†**Microcalicium ahlneri** Tibell - lignicolous; UP: 1, LP: 1.

Cheboygan: 7 mi W of Cheboygan, on stump, Aug 1977, *Wetmore* 29788 (MIN).

†**Microcalicium disseminatum** (Ach.) Vainio - lignicolous, and lichenicolous on *Chaenotheca* spp.; UP: 2, LP: 0.

Alger: Pictured Rocks NL, Munising, Sand Point, July 1987, *Wetmore* 59665 (MIN).—Keweenaw: Isle Royale NP, Spruce Point, on *Picea mariana* snag, July 1983, *Wetmore* 49043 (MIN).

Mycobilimbia berengeriana (A. Massal.) Hafellner & V. Wirth - on mossy calcareous rocks, trees, and soil; UP: 6, LP: 7.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, on *Thuja*, Sept 1972, *Harris* 7985.—Ontonagon: Porcupine Mountains, along summit of escarpment above Lake of the Clouds, Sept 1957, *Imshaug* 20443.

Mycobilimbia hypnorum (Lib.) Kalb & Hafellner - on mossy calcareous rocks, soil, and trees; UP: 8, LP: 5.

Baraga: swamp E of Sturgeon River Campground about 5 mi NE of Sidnaw, on rotten log, Sept 1972, *Harris* 7955.—Newaygo: Dudgeon swamp, S of 1 mi Rd ENE of White Cloud, on mosses at base of *Thuja*, Oct 1972, *Harris* 8169.

Mycobilimbia tetramera (De Not.) W. Brunnbauer - on mossy calcareous rocks and soil; UP: 2, LP: 0.

Keweenaw: Estivant Pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, July 1976, *Imshaug 59109*.—Marquette: N shore of Presque Isle Point, N of Marquette, Sept 1949, *Imshaug 5408*.

Mycoblastus affinis (Schaerer) Schauer - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Mycoblastus sanguinarius (L.) Norman - corticolous, on coniferous and deciduous trees; UP: 11, LP: 0.

Baraga: 3 km WSW of mouth of Huron River, *Abies*, *Betula*, and *Pinus* forest, on *Acer*, July 1977, *Malachowski 6390C*.—Keweenaw: Isle Royale NP, S side of Chippewa Harbor ca. 1.5 km SW of harbor mouth, *Thuja*, *Betula* and *Abies* forest, on *Abies*, June 1977, *Malachowski 5934C*.

Mycocalicium albonigrum (Nyl.) Fink - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Feldtman Ridge, on fallen *Betula alleghaniensis*, July 1959, *Wetmore 4881B* (MIN).

†**Mycocalicium subtile** (Pers.) Szat. - lignicolous or corticolous; UP: 7, LP: 7.

Clare: NE corner, *Thuja* bog with *Abies*, *Tsuga*, *Betula*, and *Larix* (few *Pinus strobus*), May 1959, *Erbisch 134*.—Iosco: Iargo Springs, AuSable River, NW of Tawas City, on lignum, May 1969, *Harris 4022*.

†**Mycoglaena myricae** (Nyl.) R. C. Harris - corticolous, on *Myrica gale*; UP: 3, LP: 0.

Alger: N end of Kingston Lake, on *Myrica*, Sept 1973, *Harris 6034*.—Keweenaw: SE of Lac La Belle, scattered *Picea* in bog, July 1976, *Imshaug 58770C*.

Mycoporum compositum (A. Massal.) R. C. Harris - corticolous, on deciduous trees; UP: 1, LP: 2.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Acer rubrum*, Apr 1969, *Harris 3974*.—Cheboygan: along Carp Creek between Hogsback Rd and Burt Lake, wet hardwoods, on *Acer saccharum*, Aug 1974, *Harris 9357*.

Myelochroa aurulenta (Tuck.) Elix & Hale - corticolous, on deciduous trees; UP: 12, LP: 19.

Alger: 100 m SW of Little Beaver Lake, *Betula alleghaniensis*, *Acer*, *Fagus*, and *Tsuga*, on *Fagus*, Oct 1976, *Malachowski 2989*.—Chippewa: Drummond Island, S of Beaver Pond, *Fagus-Acer* forest, on *Acer*, Oct 1976, *Imshaug 59912*.

Myelochroa galbina (Ach.) Elix & Hale - corticolous, on deciduous trees; UP: 12, LP: 6.

Baraga: 3 km WSW of mouth of Huron River, *Abies*, *Betula*, *Pinus* forest, on *Acer*, July 1977, *Malachowski 6388B*.—Chippewa: Tahquamenon River, 1 km W of the mouth of the Tahquamenon River, *Abies*, *Picea*, *Larix*, *Acer*, *Betula*, *Populus* forest, on *Acer*, July 1977, *Malachowski 7255B*.

Myelochroa obsessa (Ach.) Elix & Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Western Upper Peninsula (Harris 1977).

†**Naetrocymbe fraxini** (A. Massal.) R. C. Harris (syn. *Arthopyrenia fraxini*) - corticolous, on smooth bark of deciduous trees; UP: 1, LP: 0.

Keweenaw: Lake Medora, *Thompson 3212* (WIS) (Harris 1973).

†**Naetrocymbe punctiformis** (Ach.) R. C. Harris (syn. *Arthopyrenia punctiformis*) - corticolous, on smooth bark of deciduous trees; UP: 3, LP: 1.

Alger: in woods E of Kingston Lake and small *Chamaedaphne calyculata* bog, on *Acer rubrum*, Sept 1965, *Harris 661*.—Charlevoix: Beaver Island, Fox Lake, on *Quercus*, Aug 1961, *Imshaug 27485*.

Nephroma bellum (Sprengel) Tuck. - corticolous and saxicolous, on mossy rocks; UP: 6, LP: 2.

Cheboygan: W end of Reese's Bog, N shore of Burt Lake, on *Thuja*, July 1949, *Imshaug 3153*.—Keweenaw: Estivant Pines S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Acer*, July 1976, *Imshaug 59103*.

Nephroma helveticum Ach. - corticolous, on deciduous trees, and saxicolous, on mossy rocks; UP: 6, LP: 0.

Baraga: ca. 0.25 mi NNE of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on log, Sept 1972, *Harris 8000*.—Keweenaw: Estivant Pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Betula*, July 1976, *Imshaug 59101*.

Nephroma parile (Ach.) Ach. - corticolous, on deciduous trees, and saxicolous, on mossy rocks; UP: 7, LP: 0.

Keweenaw: Isle Royale NP, on E half of Belle Isle, *Abies*, *Populus*, *Betula*, *Picea* forest, on rock, June 1977, *Malachowski 6151*.—Marquette: Huron Mountain, N end of Mountain Lake, on steep rocky hillside with mostly *Acer*, some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3468*.

Nephroma resupinatum (L.) Ach. - corticolous, on deciduous trees, and saxicolous, on mossy rocks; UP: 4, LP: 0.

Keweenaw: 11 km NW of S Point, *Abies*, *Acer*, and *Betula* woods, on *Acer*, Oct 1976, *Malachowski 5148A*.—Marquette: Huron Mountains, Middle Falls, Salmon-Trout River, *Pinus*, *Betula*, and *Tsuga*, Oct 1976, *Malachowski 4392B*.

***Nesolechia oxyspora** (Tul.) A. Massal. - lichenicolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, (Wetmore 1997).

Normandina pulchella (Borrer) Nyl. - corticolous, on mossy deciduous trees; UP: 3, LP: 1.

Keweenaw: Isle Royale NP, Edwards Island, July 1983, *Wetmore 48495* (MIN).

Ochrolechia androgyna (Hoffm.) Arnold - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, E of Rainbow Cove, on *Thuja*, July 1984, *Wetmore 51915* (MIN).

Ochrolechia arborea (Kreyer) Almb. - corticolous; UP: 11, LP: 24.

Alger: 100 m E of entrance to Twelve-Mile Beach Campground, along Route 58, *Pinus strobus* and *Pinus banksiana* with a very few *Acer*, on *Pinus*, Oct 1976, *Malachowski 2811B*.—Marquette: Huron Mountains, 3 km NE of Howe Lake along Lake Superior shore, on *Tsuga*, Oct 1976, *Malachowski 4035*.

Ochrolechia mexicana Vainio - corticolous, on deciduous trees; UP: 5, LP: 0.

Dickinson: NE of O'Neil Lake Campground, swamp, on *Populus*, Sept 1971, *Harris* 7648.—Ontonagon: NE of Buckshot Cabin, along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Acer*, Oct 1976, *Malachowski* 5564.

Ochrolechia pseudopallescens Brodo - corticolous; UP: 7, LP: 5.

Chippewa: SW of Dick State Forest Campground, woods, on *Pinus divaricata*, Sept 1966, *Harris* 1151B.—Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, *Harris* 7514.

Ochrolechia trochophora (Vainio) Oshio var. **trochophora** - corticolous; UP: 9, LP: 3.

Keweenaw: Estivant pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Acer*, July 1976, *Imshaug* 59120.—Marquette: Huron Mountains, "Flat Rock," along Lake Superior shore, *Abies balsamea*, *Betula*, scattered *Pinus strobus*, on *Thuja*, Oct 1976, *Malachowski* 3849.

Ochrolechia trochophora var. **pruiniosella** Brodo - corticolous, on deciduous trees; UP: 1, LP: 1.

Iosco: Iargo Springs on the AuSable River, NE of Tawas City, on *Betula alleghaniensis*, May 1969, *Harris* 4017.—Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, on *Acer*, July 1976, *Imshaug* 58975.

Opegrapha niveoatra (Borrer) J. R. Laundon - corticolous; UP: 4, LP: 0.

Delta: Charboneau Point, on *Thuja*, Sept 1976, *Harris* 11783 (MIN).—Keweenaw: Isle Royale NP, bay N of Stockly Bay, on *Thuja*, July 1983, *Wetmore* 49815 (MIN).

Opegrapha prosodea Ach. - corticolous, on rough bark of old trees; UP: 2, LP: 1.

Presque Isle: point near Presque Isle Lighthouse, shore of Lake Huron, on *Thuja*, June 1958, *Imshaug* 22132.

Opegrapha varia Pers. - corticolous; UP: 5, LP: 7.

Cheboygan: W side of Hebron Mail Rd, N of Levering Rd, *Thuja* swamp, on *Thuja*, Sept 1973, *Wang* 447.—Newaygo: on *Quercus alba*, Apr 1958, *Imshaug* 21199A.

Opegrapha viridis (Pers. ex Ach.) Behlen & Desberger - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Pachyphiale fagicola (Hepp) Zwackh. - corticolous; UP: 7, LP: 7.

Chippewa: Drummond Island, along shore N of Bruce Point, in mixed conifer-hardwoods, mostly *Populus*, *Acer*, and *Thuja*, on *Thuja*, Oct 1976, *Common* 4011C.—Iosco: 5 mi W of Oscoda, between River Rd and AuSable River, *Pinus* and *Quercus* on well drained sandy soil, Apr 1971, *Common* 130A.

Pannaria conoplea (Ach.) Bory - corticolous; UP: 3, LP: 0.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Thuja*, Sept 1972, *Harris* 7976C.—Keweenaw: Isle Royale NP, along shore of Duncan Bay and up hillside below Lookout Louise, on *Populus tremuloides*, July 1977, *Malachowski* 6336B.

Pannaria pezizoides (Weber) Trevisan - terricolous, on mossy soil; UP: 4, LP: 0.

Baraga: Falls River, L'Anse, Sept 1949, *Imshaug* 4768.

Pannaria rubiginosa (Ach.) Bory - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, (Wetmore 1997).

Parmelia fraudans (Nyl.) Nyl. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: halfway down bay on N side, between Conglomerate Bay and Tonkin Bay, on rock at Jackpine Point, July 1959, *Wetmore 4290*; around Cliff Mine, 3.5 mi SE of Eagle River, around rock talus from mine and on rocky cliffs above, Aug 1972, *Wetmore 20901*.

Parmelia omphalodes (L.) Ach. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, over rock in vicinity of Tobin Harbor, swamp, June 1958, *Wetmore 1651*; about halfway down bay on N side, between Conglomerate Bay and Tonkin Bay, July 1969, *Wetmore 4249*.

Parmelia saxatilis (L.) Ach. - corticolous and saxicolous, on siliceous rocks; UP: 3, LP: 2.

Chippewa: N side of Andrus Lake, State Forest Campground, in *Pinus strobus-Quercus* forest, on *Quercus*, Oct 1975, *Malachowski 1530B*.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, Oct 1976, *Malachowski 3693*.

Parmelia squarrosa Hale - corticolous and saxicolous, on siliceous rocks; UP: 14, LP: 15.

Alpena: 1.7 mi S of Thunder Bay River on Herron Rd, Kalmia bog areas, *Chamaedaphne* mat, July 1971, *Vitt 4141*.—Crawford: *Thuja* bog near Grayling, on *Abies*, May 1958, *Imshaug 21433*.

Parmelia sulcata Taylor - corticolous, on coniferous and deciduous trees; UP: 17, LP: 47.

Cheboygan: N of Dingman Marsh Flooding, N of Potter Rd, *Thuja-Picea-Betula* swamp, on *Tsuga*, Sept 1973, *Wang 498*.—Iosco: Iargo Springs area, 18 mi W of Oscoda, *Thuja-Betula-Picea* swamp, on *Thuja*, Sept 1973, *Wang 585*.

Parmeliella triptophylla (Ach.) Müll. Arg. - corticolous and saxicolous; UP: 1, LP: 0.

Keweenaw: along Siskiwit Falls River from Siskiwit Lake to Malone Bay, on rock, June 1958, *Wetmore 2417*; Isle Royale NP, Hay Bay swamp and along S side of river at end of Hay Bay, on *Thuja*, June 1958, *Wetmore 2516*.

Parmelina quercina (Willd.) Hale - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Parmeliopsis ambigua (Wulfen) Nyl. - corticolous, on coniferous and deciduous trees; UP: 12, LP: 7.

Chippewa: Drummond Island, E side of Bass Cove, Oct 1976, *Imshaug 59899*; on *Thuja*, Oct 1976, *Imshaug 59863*.

Parmeliopsis capitata R. C. Harris - corticolous, on coniferous trees; UP: 4, LP: 0.

Chippewa, Delta, Keweenaw, and Mackinac (MICH) (Harris 1977).

Parmeliopsis hyperopta (Ach.) Arnold - lignicolous and corticolous, on coniferous trees; UP: 9, LP: 2.

Baraga: Lake Superior, 500 m W of mouth of Huron River, sandy shore with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, on log, July 1977, *Malachowski 6372D*.—Chippewa: Bayview Campground, along shore of Lake Superior, in *Acer, Betula, Pinus banksiana* forest, on stump, July 1977, *Malachowski 7274C*.

Parmotrema arnoldii Hale - on mossy rocks and trees; UP: 5, LP: 0.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Thuja*, Sept 1972, *Harris* 7960.—Chippewa: ca. 1 mi E of Mackinac County, bog, Aug 1949, *Imshaug* 3349A.

Parmotrema chinense (Osbeck) Hale - on mossy rocks and trees; UP: 3, LP: 9.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Thuja*, May 1970, *Harris* 5886.—Delta: along Bill's Creek at County Rd 509, NE of Rapid River, moist woods, on *Betula alleghaniensis*, Sept 1969, *Harris* 4184.

Parmotrema crinitum (Ach.) M. Choisy - on mossy rocks and trees; UP: 13, LP: 10.

Delta: along Haymeadow Creek Falls Nature Trail, NE of Rapid River, moist woods, on *Betula alleghaniensis*, Sept 1969, *Harris* 4196.—Dickinson: S end of O'Neil Lake, *Thuja-Picea* swamp, on *Thuja*, Sept 1971, *Harris* 7435.

Parmotrema hypotropum (Nyl.) Hale - on mossy rocks and trees; UP: 0, LP: 1.

Washtenaw (*Harris* 1977).

Parmotrema margaritatum (Hue) Hale - on mossy rocks and trees; UP: 0, LP: 2.

Charlevoix: Beaver Island, bluff near Barney Lake, on *Thuja*, Aug 1961, *Imshaug* 27752.—Newaygo: Dudgeon Swamp, S of One-Mile Rd, ENE of White Cloud, Oct 1972, *Harris* 8159.

Parmotrema perforatum (Jacq.) A. Massal. - on mossy rocks and trees; UP: 0, LP: 2.

Jackson: 2 mi SW of Gautier, on fallen *Quercus* branches, Feb 1973, *Killebrew s.n.* (MIN).

Parmotrema stuppeum (Taylor) Hale - on mossy rocks and trees; UP: 2, LP: 1.

Iron: Teepee Lake, S of Kenton, Sept 1964, *Harris s.n.*—Presque Isle: Hammond Bay, *Thuja* swamp along Lake Huron, July 1967, *Harris* 3693.

Parmotrema tinctorum (Delise ex Nyl.) Hale - on mossy rocks and trees; UP: 0, LP: 1.

Jackson: Ocean Springs, on live *Quercus* bark, Aug 1954, *Demaree* 35983 (MIN), on dead tree bark, Jan 1955, *Demaree* 36377 (MIN).

Peltigera aphthosa (L.) Willd. - on shaded, mossy ground; UP: 6, LP: 1.

Keweenaw: Isle Royale NP, Cork Island, SE of Belle Isle, *Thuja*, *Abies*, *Betula*, June 1977, *Malachowski* 6106.—Marquette: Huron Mountains, Middle Falls, Salmon-Trout River, *Pinus*, *Betula*, and *Tsuga*, Oct 1976, *Malachowski* 4329.

Peltigera canina (L.) Willd. - on shaded ground and rocks; UP: 12, LP: 18.

Alger: 2 km N of Little Beaver Lake Campground, *Abies*, *Acer*, and *Betula papyrifera*, Oct 1976, *Malachowski* 3208.—Marquette: Huron Mountains, Mt Ida, W side of Lake Ann, *Tsuga*, *Acer*, *Betula*, and *Pinus*, Oct 1976, *Malachowski* 4145.

Peltigera collina (Ach.) Schrader - on shaded mossy deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (*Wetmore* 1997).

Peltigera degenii Gyelnik - on mossy ground; UP: 2, LP: 0.

Marquette: Huron Mountains, Middle Falls, Salmon-Trout River, *Pinus*, *Betula* and *Tsuga*, Oct 1976, *Malachowski* 4389.—Ontonagon: Misery Bay, near mouth of Little Misery River, hardwoods and conifers, Oct 1976, *Malachowski* 5395.

Peltigera didactyla (With.) J. R. Laundon - usually on open ground; UP: 11, LP: 11.

Cheboygan: S of Hebron Mail Rd, 2 mi N of Levering Rd, *Thuja* swamp, on rotten log, June 1973, Wang 276.—Dickinson: along road into O'Neil Lake Campground, *Picea-Pinus banksiana*-*Populus* woods, on road bank, Sept 1971, Harris 7402.

Peltigera elisabethae Gyelnik - on mossy ground; UP: 10, LP: 4.

Keweenaw: High Rock Bay, Lake Superior shore, *Abies balsamea*, *Betula*, and *Pinus strobus*, Oct 1976, Malachowski 4711B.—Marquette: Huron Mountain Club, Salmon-Trout River, 1.2 km N of entrance at Huron Mountain Club, Oct 1977, Malachowski 4240.

Peltigera evansiana Gyelnik - on mossy rocks and trees; UP: 12, LP: 8.

Chippewa: Drummond Island, N of Bruce Point, along shore in mixed conifer-hardwoods, Oct 1976, Imshaug 60056.—Leelanau: Lighthouse Point, along shore of Lake Michigan at N tip of Leelanau Peninsula, June 1957, Imshaug 19503.

Peltigera horizontalis (Hudson) Baumg. - on mossy rocks and corticolous, on deciduous trees; UP: 8, LP: 3.

Keweenaw: Isle Royale NP, Smithwick Island, June 1958, Wetmore 1478; Isle Royale NP, Tobin Harbor swamp and vicinity, near trail to Mt Franklin, June 1958, Wetmore 1704A.

Peltigera lepidophora (Vainio) Bitter - on sandy ground and mosses; UP: 4, LP: 2.

Baraga: 0.5 mi N of Sturgeon River Campground, 5 mi NE of Sidnaw, *Populus* woods, Sept 1972, Harris 8151.

Peltigera leucophlebia (Nyl.) Gyelnik - on shaded, mossy ground and rocks; UP: 7, LP: 6.

Iosco: Iargo Springs area, 18 mi W of Oscoda, *Thuja-Betula-Picea* swamp, base and roots of *Thuja*, Sept 1973, Wang 570.—Keweenaw: Estivant pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on rock, July 1976, Imshaug 59092.

Peltigera malacea (Ach.) Funck - usually on open ground; UP: 4, LP: 0.

Marquette: Huron Mountain, N end of Mountain Lake, mostly *Acer*, some *Pinus*, steep rocky hillside, on granite cliff face, Oct 1976, Malachowski 3442.—Ontonagon: Porcupine Mountains, along summit of escarpment above Lake of the Clouds, Sept 1957, Imshaug 20463.

Peltigera membranacea (Ach.) Nyl. - on mossy ground; UP: 3, LP: 0.

Houghton: Beacon Hill, July 1967, Erbsich 1805.—Keweenaw: Isle Royale NP, SW end of Mott Island, over rock, June 1957, Wetmore 317.

Peltigera neckeri Hepp ex Müll. Arg. - on open ground; UP: 4, LP: 0.

Clare: NW of Long Lake, *Ulmus-Fraxinus*-Cedar swamp, Oct 1968, Ohlsson 14; between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, June 1973, Wang 70.

Peltigera neopolydactyla (Gyelnik) Gyelnik - on mossy ground; UP: 2, LP: 0.

Baraga: NE of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, Sept 1972, Harris 7886.—Dickinson: S of road into O'Neil Lake Campground, *Thuja-Picea* swamp, *Sphagnum*, Sept 1971, Harris 7500.

Peltigera polydactylon (Necker) Hoffm. - on mossy ground and trees; UP: 11, LP: 7.

Iosco: Iargo Springs area, 18 mi W of Oscoda, *Thuja-Betula-Picea* swamp, on *Thuja*, Sept 1973, Wang 557.

Peltigera ponojensis Gyelnik - on mossy ground and trees; UP: 1, LP: 1.

Delta: NW of Isabella, road ballast pit on USFS 2231, 1.5 mi W of USFS 2226, Sept 1969, *Harris* 4228.—Oscoda: E of Wagner Lake, ca. 7 mi E of Mio, *Pinus banksiana* woods, Sept 1973, *Harris* 8331.

Peltigera praetextata (Flörke ex Sommerf.) Zopf - on mossy ground and deciduous trees; UP: 13, LP: 16.

Keweenaw: Isle Royale NP, Island, on Island Mine Trail, July 1959, *Wetmore* 4980.—Ontonagon: Manabanzo Falls, Big Presque Isle River, *Tsuga*, *Betula*, *Thuja*, and *Pinus* woods, Oct 1976, *Malachowski* 5645.

Peltigera rufescens (Weiss) Humb. - on open ground; UP: 13, LP: 13.

Chippewa: Drummond Island, N of Bruce Point, along shore in mixed-conifer-hardwoods, Oct 1976, *Imshaug* 60057.

Peltigera scabrosa Th. Fr. - on mossy ground; UP: 0, LP: 1.

Clare (*Harris* 1977).

Peltigera venosa (L.) Hoffm. - on shaded, mossy ground; UP: 1, LP: 0.

Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug* 58974; Isle Royale NP, on Rock Harbor side of Davidson Island, shaded mossy cliff, June 1958, *Wetmore* 2629.

Pertusaria alpina Hepp ex Ahles - corticolous, on deciduous trees; UP: 7, LP: 0.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Fraxinus*, Sept 1972, *Harris* 7981.—Keweenaw: shore of Lake Superior with low cliffs, and adjacent woods with *Sphagnum* and boulders, N side of Gay, July 1976, *Imshaug* 59190.

Pertusaria amara (Ach.) Nyl. - corticolous; UP: 12, LP: 13.

Chippewa: Drummond Island, E side of Bass Cove, on *Thuja*, Oct 1976, *Imshaug* 59909.—Keweenaw: Estivant pines. S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Acer*, July 1976, *Imshaug* 59121.

Pertusaria consocians Dibben - corticolous, on deciduous trees; UP: 3, LP: 1.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Betula alleghaniensis*, Oct 1968, *Harris* 3910.—Marquette: Huron Mountains, shore of Lake Superior at Conway Bay, Sept 1949, *Imshaug* 5231.

Pertusaria dactylina (Ach.) Nyl. - usually on plant debris on ground; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE of Thompson Island, on *Abies balsamea*, July 1984, *Wetmore* 51557 (MIN).

Pertusaria leioplaca DC. - corticolous, on deciduous trees; UP: 3, LP: 2.

Clare: NW of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Fraxinus*, Oct 1968, *Ohlsson* 18.—Dickinson: road into O'Neil Lake Campground, *Picea-Pinus banksiana-Populus* woods, on *Populus*, Sept 1971, *Harris* 7549.

Pertusaria macounii (Lamb) Dibben - corticolous, on deciduous trees; UP: 12, LP: 9.

Iosco: along the AuSable River, NW of Tawas City, swampy area, on *Betula alleghaniensis*, May 1969, *Ohlsson* 167.—Marquette: Huron Mountains, Fortress, NE of Mountain Lake, Sept 1949, *Imshaug* 5311.

Pertusaria multipunctoides Dibben - corticolous, on deciduous trees; UP: 7, LP: 1.

Baraga: L'Anse, Falls River, Sept 1949, *Imshaug* 4890.—Mackinac: NW of Cedarville, conifer woods, Aug 1949, *Imshaug* 3675.

Pertusaria neoscotica Lamb - corticolous, on coniferous and deciduous trees; UP: 3, LP: 1.

Keweenaw: Isle Royale NP, In Siskiwit swamp near mouth of Big Siskiwit River, on *Thuja*, July 1959, *Wetmore* 5023A.—Washtenaw: dry woods NW of Crooked Lake, on *Quercus*, Apr 1964, *Harris s.n.*

Pertusaria oculata (Dickson) Th. Fr. - usually on plant debris on ground; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S shore of Grace Harbor, on *Thuja*, July 1984, *Wetmore* 51815 (MIN).

Pertusaria ophthalmiza (Nyl.) Nyl. - corticolous, on coniferous and deciduous trees; UP: 10, LP: 5.

Marquette: W side of the Huron Mountains, near Cliff Lake, Sept 1949, *Imshaug* 4344.—Oscoda: Watson Rd, Mio, on *Acer rubrum*, Sept 1973, *Harris* 8405.

Pertusaria propinqua Müll. Arg. - corticolous, on deciduous trees; UP: 0, LP: 3.

Leelanau: near Clinton, upland hardwoods, Apr 1958, *Imshaug* 21273.

Pertusaria pustulata (Ach.) Duby - corticolous, on deciduous trees; UP: 1, LP: 5.

Allegan: between Mt Baldhead and Lake Michigan shore, on *Quercus*, June 1957, *Imshaug* 19676.—Shiawassee: Rose Lake Exp. Station, Woodhall Twp, Apr 1957, *Wetmore* 35B.

Pertusaria rubefacta Erichsen - corticolous, on deciduous trees; UP: 6, LP: 2.

Marquette: Huron Mountains, shore of Lake Superior, at Conway Point, Sept 1949, *Imshaug* 5255.—Oscoda: W of Watson Rd, ca. 7.5 mi S of Mio, wet *Fraxinus-Acer rubrum* swamp, on *Betula alleghaniensis*, Sept 1973, *Harris* 8418.

Pertusaria sommerfeltii (Flörke ex Sommerf.) Fr. - corticolous, on coniferous and deciduous trees; UP: 2, LP: 0.

Baraga: NE of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Thuja*, Sept 1972, *Harris* 7844.—Keweenaw: Isle Royale NP, mouth of Big Siskiwit River, in Siskiwit swamp on *Thuja*, July 1959, *Wetmore* 5014.

Pertusaria trachythallina Erichsen - corticolous, on deciduous trees; UP: 6, LP: 3.

Keweenaw: between Lac La Belle and Deer Lake, sandy area with *Populus*, *Pteridium aquilinum*, and *Cladina* mats, on *Acer*, July 1976, *Imshaug* 58800.—Mackinac: NW of Cedarville, conifer woods, Aug 1949, *Imshaug* 3678.

Pertusaria velata (Turner) Nyl. - corticolous, on deciduous trees; UP: 11, LP: 11.

Alger: 100 m SW of Little Beaver Lake, *Betula alleghaniensis*, *Acer*, *Fagus*, and *Tsuga*, on *Acer*, Oct 1976, *Malachowski* 2939.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Acer*, Oct 1976, *Malachowski* 3656.

Pertusaria waghornei Hulting - corticolous; UP: 2, LP: 1.

Clare: between US Hwy 27 and old US 27, 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Acer rubrum*, Apr 1969, *Harris* 3978.—Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, on *Betula*, July 1976, *Imshaug* 58954.

†**Phaeocalicium compressulum** (Nyl. ex Szat.) A. F. W. Schmidt - on *Alnus* twigs; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, on *Alnus*, July 1983, *Wetmore 49635* (MIN); Isle Royale NP, Johns Island in Washington Harbor, on *Alnus*, July 1984, *Wetmore 51674* (MIN).

†**Phaeocalicium curtisii** (Tuck.) Tibell - on *Rhus*; UP: 0, LP: 2.

Leelanau: Sleeping Bear Dunes NL, W of Bass Lake, on sumac, July 1987, *Wetmore 58412* (MIN).—Midland: Black Creek near Sanford, on *Rhus*, May 1958, *Imshaug 21653* (MIN).

†**Phaeocalicium polyporaeum** (Nyl.) Tibell - on old polypore fungi on trees; UP: 4, LP: 6.

Keweenaw: Isle Royale NP, Mt Franklin, on *Populus tremuloides*, Aug 1972, *Wetmore 21085* (MIN).—Marquette: 3 mi S of Marquette, on dead *Populus*, June 1977, *Erbisch 4835* (MIN).

†**Phaeocalicium populneum** (Brond. ex Duby) A. F. W. Schmidt - on *Populus* twigs; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, Daisy Farm in Rock Harbor, on *Populus balsamifera*, July 1983, *Wetmore 47918* (MIN).—Mackinac: Mackinac SF, Big Knob Rd, 0.5 mi from US 2, on *Populus balsamifera* twigs, May 1977, *Buck 1659* (MIN).

Phaeographis dendritica (Ach.) Müll. Arg. - corticolous, on deciduous trees; UP: 0, LP: 1.

Emmet: off Robinson Rd near Middle Village, on *Acer saccharum*, Aug 1967, *Engel 1131*.

Phaeographis sericea (Eschw.) Müll. Arg. - corticolous, on deciduous trees; UP: 0, LP: 1.

Jackson: Ocean Springs, on *Hamamelis*, Oct 1974, *Tucker 13083* (MIN).

Phaeophyscia adiastrum (Essl.) Essl. - saxicolous, over mosses on siliceous rocks and trees; UP: 1, LP: 3.

Jackson: NE of Jackson, on *Carya*, June 1979, *Harris 13075* (MIN).—Keweenaw: Isle Royale NP, Sugar Mountain, on *Acer saccharum*, July 1984, *Wetmore 52619* (MIN).

Phaeophyscia cernohorskyi (Nádv.) Essl. - saxicolous, on siliceous rocks, and corticolous, on deciduous trees; UP: 0, LP: 1.

Leelanau: Sleeping Bear Dunes NL, E of Sleeping Bear Dune, on *Populus grandidentata*, July 1987, *Wetmore 58171* (MIN).

Phaeophyscia ciliata (Hoffm.) Moberg - corticolous, on deciduous trees; UP: 10, LP: 20.

Chippewa: Drummond Island, E of Bruce Point, *Populus-Thuja* forest, Oct 1976, *Common 4001F*.—Ontonagon: NE of Buckshot Cabin, along shore of Lake Superior, *Abies*, *Populus*, and *Betula* woods, on *Populus tremuloides*, Oct 1976, *Malachowski 5553*.

Phaeophyscia constipata (Norrlin & Nyl.) Moberg - terricolous, on calcareous ground among mosses; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE tip of Passage Island, July 1983, *Wetmore 47507* (MIN).

Phaeophyscia decolor (Kashiw.) Essl. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, McCargo Cove, exposed to lake winds, on *Nephroma parile* on bare rock under *Alnus* branch, Aug 1930, *Povah, Brown, McFarlin & Lowe* 375 (MICH); Isle Royale NP, Ryan island, on bare rock on shore exposed to some shade, Sept 1930, *Povah, Brown, McFarlin & Lowe* 873 (MICH).

Phaeophyscia endococcina (Körber) Moberg - corticolous and saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, South Government Island, July 1980, *Wetmore* 41037 (MIN); Isle Royale NP, West Caribou Island, on *Thuja*, July 1983, *Wetmore* 46656 (MIN).

Phaeophyscia endococcinodes (Tuck.) Essl. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Lookout Louise, July 1983, *Wetmore* 46795 (MIN).

Phaeophyscia erythrocardia (Tuck.) Essl. - corticolous; UP: 1, LP: 0.

Marquette: Huron Mountains, Fortress, NE of Mountain Lake, Sept 1949, *Imshaug* 1949 (MICH).

Phaeophyscia hirsuta (Mereschk.) Essl. - saxicolous, on siliceous rocks, and corticolous, on deciduous trees; UP: 0, LP: 1.

Leelanau: Sleeping Bear Dunes NL, at N tip of Pyramid Point, on *Prunus*, July 1987, *Wetmore* 58359 (MIN).

Phaeophyscia hirtella Essl. - corticolous, on deciduous trees; UP: 3, LP: 0.

Baraga: 5 mi NE of Sidnaw, on *Populus tremuloides*, Sept 1972, *Harris* 8011 (MIN).—Keweenaw: Isle Royale NP, Wallace Lake, on *Populus tremuloides*, July 1983, *Wetmore* 47592 (MIN).

Phaeophyscia hispidula (Ach.) Essl. - corticolous, on deciduous trees; UP: 6, LP: 3.

Baraga: Sturgeon River upstream from bridge, 5 mi NE of Sidnaw, wet woods, on *Fraxinus*, Sept 1972, *Harris* 8077.—Charlevoix: Beaver Island, base of bluff, Aug 1961, *Imshaug* 27721.

Phaeophyscia orbicularis (Necker) Moberg - corticolous, on deciduous trees; UP: 6, LP: 12.

Clare: near Clare, *Thuja* bog, on *Ulmus*, Apr 1958, *Imshaug* 21058.—Houghton: along shore at upper entrance to Keweenaw Waterway, on W side of channel, on *Acer*, June 1958, *Wetmore* 1230.

Phaeophyscia pusilloides (Zahlbr.) Essl. - corticolous, on deciduous trees; UP: 13, LP: 21.

Baraga: ca. 0.25 mi NNE of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, on *Populus tremuloides*, Sept 1972, *Harris* 8010.—Oscoda: W of Watson Rd, ca. 7.5 mi S of Mio, *Fraxinus-Acer rubrum* swamp, on *Fraxinus*, Sept 1973, *Harris* 8426.

Phaeophyscia rubropulchra (Degel.) Essl. - corticolous, on deciduous trees; UP: 13, LP: 28.

Mackinac: Little Brevort Lake, *Fagus-Acer* forest, on *Acer*, June 1975, *Imshaug* 58590.—Newaygo: S of Four-Mile Rd, 6 mi NE of White Cloud, old *Thuja* swamp, on *Acer saccharum*, Sept 1973, *Wang* 329.

Phaeophyscia sciastra (Ach.) Moberg - saxicolous, on siliceous rocks; UP: 7, LP: 0.

Chippewa: Drummond Island, E side of Bass Cove, Oct 1976, *Imshaug 59910*.—Keweenaw: High Rock Bay, Lake Superior shore, *Abies balsamea*, *Betula* and *Pinus strobus*, on rock, Oct 1976, *Malachowski 4812*.

Phaeophyscia squarrosa Kashiw. (*P. imbricata* sensu Essl.) - corticolous, on deciduous trees; UP: 2, LP: 2.

Clare: between US Hwy 27 and old US 27, ca. 2 mi N of Long Lake, *Ulmus-Fraxinus-Thuja* swamp, on *Ulmus*, Apr 1969, *Harris 3954*.—Ontonagon: Porcupine Mts, summit of escarpment above Lake of the Clouds, on *Acer*, Sept 1957, *Imshaug 220465*.

Phlyctis argena (Sprengel) Flotow - corticolous; UP: 7, LP: 10.

Cheboygan: E of Pine Grove Campground, *Thuja* swamp, on *Thuja*, Aug 1972, *Harris 7809*.—Schoolcraft: Manistique River, on *Acer*, Oct 1975, *Malachowski 1620*.

Physcia adscendens (Fr.) H. Olivier - corticolous, on deciduous trees; UP: 11, LP: 41.

Chippewa: Drummond Island, N of Bruce Point, along shore in mixed conifer-hardwoods, on *Populus*, Oct 1976, *Imshaug 60015*.—Clinton: NW side of Rose Lake, very moist deciduous forest, July 1979, *Fruit 5C*.

Physcia aipolia (Ehrh. ex Humb.) Fűrnr. - corticolous, on deciduous trees; UP: 13, LP: 28.

Chippewa: Drummond Island, N of Bruce Point, along shore in mixed conifer-hardwoods, on *Populus*, Oct 1976, *Imshaug 60062*.

Physcia americana G. Merr. - corticolous, on deciduous trees; UP: 0, LP: 5.

Allegan: Mt Baldhead, near Saugatuck, summit of sand dune, on *Tilia*, June 1957, *Imshaug 19672*.—Newaygo: S of Four-Mile Rd, 6 mi NE of White Cloud, old *Thuja* swamp, on *Acer*, Sept 1973, *Wang 321*.

Physcia caesia (Hoffm.) Fűrnr. - saxicolous, on calcareous rocks; UP: 5, LP: 0.

Keweenaw: N side of Gay, shore of Lake Superior with low cliffs and adjacent woods with *Spahgnum* and boulders, July 1976, *Imshaug 59154B*, *59169*.

Physcia dubia (Hoffm.) Lattau - saxicolous and corticolous, on deciduous trees; UP: 5, LP: 4.

Chippewa: Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug 60127B*.—Keweenaw: along shore, High Rock Bay, Lake Superior shore, *Abies balsamea*, *Betula*, and *Pinus strobus*, on rock, Oct 1976, *Malachowski 4769A*.

Physcia millegrana Degel. - corticolous, on deciduous trees; UP: 5, LP: 49.

Chippewa: Drummond Island, N of Bruce Point, along shore in mixed conifer-hardwoods, on *Acer*, Oct 1976, *Imshaug 60008*.—Oscoda: near Wagner Lake, ca. 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, on *Quercus*, Sept 1973, *Harris 8222*.

Physcia phaea (Tuck.) J. W. Thomson - saxicolous, on siliceous rocks; UP: 1, LP: 1.

Keweenaw: High Rock Bay, Lake Superior shore, *Abies balsamea*, *Betula*, and *Pinus strobus*, on rock, Oct 1976, *Malachowski 4810*; Isle Royale NP, Lake Superior side of Mott Island, near headquarters site, June 1957, *Wetmore 236C*.

Physcia stellaris (L.) Nyl. - corticolous, on deciduous trees; UP: 13, LP: 47.

Chippewa: Drummond Island, along road at Drummond airport, on *Acer*, Oct 1976, *Imshaug* 60156.—Ontonagon: NE of Buckshot Cabin, woods along shore of Lake Superior, on *Populus*, Oct 1976, *Malachowski* 5546.

Physcia subtilis Degel. - saxicolous, on siliceous rocks; UP: 4, LP: 3.

Marquette: Huron Mountains, N end of Mountain Lake, steep rocky hillside with mostly *Acer*, some *Pinus*, on granite cliff face, Oct 1976, *Malachowski* 3465, 3558.

Physcia tenella (Scop.) DC. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royal NP, Smithwick Island, on *Betula papyrifera*, June 1958, *Wetmore* 1493B; Isle Royale NP, Long Island, on *Betula papyrifera*, July 1959, *Wetmore* 5093.

Physcia wainioi Räsänen - saxicolous and corticolous, on deciduous trees; UP: 2, LP: 0.

Gogebic: Sandstone Falls, Black River, mixed hardwood-conifer forest, Sept 1957, *Imshaug* 20716.—Keweenaw: N side of Gay, shore of Lake Superior with low cliffs and adjacent woods with *Sphagnum* and boulders, July 1976, *Imshaug* 59171.

Physciella chloantha (Ach.) Essl. - corticolous, on deciduous trees; UP: 1, LP: 2.

Eaton: 12 mi E of Charlotte, off Bunker Hwy, on *Populus tremuloides*, Aug 1974, *Wang* 1048.—Montmorency: 4 mi S of Atlanta, off County Rd 487, on *Populus tremuloides*, Aug 1974, *Wang* 935.

Physconia detera (Nyl.) Poelt - on mossy rocks and tree trunks; UP: 13, LP: 32.

Cheboygan: S of Hebron Mail Rd, 2 mi N of Levering Rd, hardwood stand just N of *Thuja* swamp, on *Fraxinus*, June 1973, *Wang* 302.—Keweenaw: Isle Royale NP, along shore of Duncan Bay and up hillside below Lookout Louise, on *Thuja*, July 1977, *Malachowski* 6333.

Physconia leucoleiptes (Tuck.) Essl. - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Physconia muscigena (Ach.) Poelt - usually on mosses on the ground; UP: 1, LP: 0.

Keweenaw: 350 m N of Mendota Canal, Bete Grise Bay, along shore of Lake Superior, *Abies*, *Betula*, and *Acer* woods, Oct 1976, *Malachowski* 5069C; Isle Royale NP, along the shore of Blakes Point, in *Thuja*, *Abies*, *Betula* forest on rocks, June 1977, *Malachowski* 6033B.

Physconia perisidiosa (Erichsen) Moberg - corticolous, on deciduous trees; UP: 5, LP: 4.

Keweenaw: Isle Royale NP, Hay Point, in parkland like community of *Fraxinus*, *Betula*, *Thuja*, and *Abies*, on *Populus tremuloides*, June 1977, *Malachowski* 5895A.—Marquette: Huron Mountain, N end of Mountain Lake, mostly *Acer*, and some *Pinus* on steep rocky hillside, on *Acer*, Oct 1976, *Malachowski* 3367.

Placidium lachneum (Ach.) Breuss (syn. *Catapyrenium lachneum*) - terricolous, on calcareous soils; UP: 1, LP: 0.

Chippewa: Drummond Island, Maxton Plains, on soil with dolostone pavement, May 198, *Marr* 8421 (MIN).

Placidium michelii (A. Massal.) Breuss (syn. *Catapyrenium michelii*) - terricolous, on sandy soils; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49597* (MIN).

Placynthiella dasaea (Stirton) Tønsberg - corticolous, on deciduous trees, and terricolous; UP: 2, LP: 1.

Keweenaw: Isle Royale NP, inside Chippewa Harbor, July 1983, *Wetmore 47121* (MIN).—Leelanau: Sleeping Bear Dunes NL, center of South Manitou Island, July 1987, *Wetmore 58457* (MIN).

Placynthiella icmalea (Ach.) Coppins & P. James - corticolous, on deciduous trees, and terricolous; UP: 2, LP: 1.

Benzie: Sleeping Bear Dunes NL, Little Platte Lake, June 1987, *Wetmore 58006* (MIN).—Keweenaw: Isle Royale NP, Old Feldtman Tower, July 1983, *Wetmore 48571* (MIN).

Placynthiella oligotropha (J. R. Laundon) Coppins & P. James - terricolous, on humus-rich soil; UP: 4, LP: 2.

Benzie: Sleeping Bear Dunes NL, NE of Bass Lake, at Trails End, June 1987, *Wetmore 57973* (MIN).—Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49626* (MIN).

Placynthiella uliginosa (Schrader) Coppins & P. James - on lignum, plant debris, and soil; UP: 5, LP: 12.

Jackson: Sharonville State Game Area, dry fields, on lignum, June 1970, *Harris 5948*.—Lake: Kelley Creek, 17 mi SW of Ely, in cut over *Picea mariana* swamp with *Alnus* and sapling *Populus tremuloides*, June 1977, *Wetmore 28095*.

Placynthium asperellum (Ach.) Trevisan - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, along shore at SW end, on outside (facing Lake Superior), June 1958, *Wetmore 1636B*; Isle Royale NP, Capt. Kidd Island (NE of Amygdaloid Island), July 1959, *Wetmore 4695*.

Placynthium nigrum (Hudson) Gray - saxicolous, on calcareous rocks; UP: 5, LP: 4.

Chippewa: Drummond Island, E side of Big Shoal Cove, scattered *Thuja* with exposed limestone pavement and low *Juniperus*, Oct 1976, *Imshaug 59960*.—Leelanau: along shore of Lake Michigan at Lighthouse Point, N tip of Leelanau Peninsula, June 1957, *Imshaug 19490*.

Platismatia glauca (L.) Culb. & C. Culb. - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Keweenaw: along Central Creek, swampy area with *Abies*, *Betula*, *Thuja*, and *Acer*, on *Abies*, Oct 1976, *Malachowski 4916, 4994*.

Platismatia tuckermanii (Oakes) Culb. & C. Culb. - corticolous, on coniferous and deciduous trees; UP: 14, LP: 12.

Keweenaw: 1.2 km past end of Route 41 on hill overlooking Lake Superior, in *Abies*, *Betula* woods, on *Abies*, June 1977, *Malachowski 5703A*.—Ontonagon: Misery Bay, near mouth of Little Misery River, hardwoods and conifers, on *Betula papyrifera*, Oct 1976, *Malachowski 5400*.

Polyblastia cupularis A. Massal. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Edwards Island, July 1983, *Wetmore 48414* (MIN); Isle Royale NP, Huginnin Cove, July 1984, *Wetmore 52341* (MIN).

Polyblastia theleodes (Sommerf.) Th. Fr. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, middle of Passage Island, July 1983, *Wetmore 47449* (MIN).

Polychidium muscicola (Sw.) Gray - on damp, mossy siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, on rock at Jackpine Point, about halfway down bay on N side, between Conglomerate Bay and Tonkin Bay, July 1959, *Wetmore 4264A*.—Marquette: hills N of Mountain Lake, Sept 1949, *Imshaug 5150*.

Polysporina simplex (Davies) Vezda - saxicolous, on siliceous rocks; UP: 0, LP: 3.

Emmet, Livingston, Washtenaw: non-calcareous rock (Harris 1977).

Porpidia albocaerulescens (Wulfen) Hertel & Knoph - saxicolous, on siliceous rocks; UP: 1, LP: 3.

Alger: Pictured Rocks NL, S of Beaver Lake, at Lowney Creek, July 1987, *Wetmore 59350* (MIN).

Porpidia calcarea Gowan - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, middle of Passage Island, July 1983, *Wetmore 47460* (MIN - holotype); Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49551* (MIN).

Porpidia cinereoatra (Ach.) Hertel & Knoph - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore 47246* (MIN).

Porpidia crustulata (Ach.) Hertel & Knoph - saxicolous, on siliceous rocks; UP: 7, LP: 2.

Alger: W of Kingston Lake, open fields, Sept 1970, *Harris 6070*.—Baraga: old borrow pit near Sturgeon River Bridge, ca. 5 mi NE of Sidnaw, Sept 1972, *Harris 8038*.

Porpidia diversa Gowan - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Net Island (NE of Amygdaloid Island), July 1984, *Wetmore 51455* (MIN); Isle Royale NP, W end of Minong Ridge Trail, July 1984, *Wetmore 52420* (MIN).

Porpidia herteliana Gowan - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, 1 mi S of Huginnin Cove, July 1984, *Wetmore 52815* (MIN - holotype).

Porpidia macrocarpa (DC.) Hertel & Knoph - saxicolous, on siliceous rocks; UP: 7, LP: 9.

Alger: near Little Beaver Lake, Lake Superior shore, Sept 1964, *Harris s.n.*.—Clinton: Rose Lake Game Area, SE of junction of Clark and Peacock Rds, Apr 1969, *Harris 3984*.

Porpidia speirea (Ach.) Kremp. - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Raspberry Island, Aug 1972, *Thomson 17379* (MIN); Isle Royale NP, middle of Passage Island, July 1983, *Wetmore 47491* (MIN).

Porpidia superba (Körber) Hertel & Knoph - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, N of Lake Desor at shore of Lake Superior, shore and in trees near shore, on rocks, July 1984, *Wetmore 53099* (MIN).

Porpidia thomsonii Gowan - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw (Gowan 1989).

Protoblastenia rupestris (Scop.) J. Steiner - saxicolous, on calcareous rocks; UP: 4, LP: 6.

Chippewa: Drummond Island, along shore, N of Bruce Point, mixed conifer-hardwoods, Oct 1976, *Imshaug 59997*.—Oscoda: Wagner Lake, Mio, hills N of Mountain Lake, dry *Pinus banksiana-Quercus* woods, Sept 1973, *Harris 8227A*.

Protoblastenia siebenhaariana (Körber) J. Steiner - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, middle of Passage Island, July 1983, *Wetmore 47505* (MIN).

Protoparmelia badia (Hoffm.) Hafellner - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore 41397* (MIN); Isle Royale NP, Edwards Island, July 1983, *Wetmore 48444* (MIN).

Pseudevernia consocians (Vainio) Hale & Culb. - corticolous, on coniferous and deciduous trees; UP: 10, LP: 3.

Keweenaw: shore of Lake Superior at Bear Creek, E of Bete Grise, on fallen *Abies*, July 1976, *Imshaug 58982*; Isle Royale NP, on S side of Chippawa River, about 1.5 km, SW of harbor mouth, *Thuja*, *Betula*, *Abies* forest, on *Fraxinus*, June 1977, *Malachowski 5924B*.

Pseudocyphellaria crocata (L.) Vainio - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, South Government Island, July 1984, *Wetmore 53278* (MIN).

Pseudoparmelia cubensis (Nyl.) Elix & T. Nash - corticolous, on deciduous trees; UP: 0, LP: 2.

Jackson: Ocean Springs, base of live *Quercus* trees, Aug 1954, *Demaree 35974, 35979B* (MIN).

Psilolechia lucida (Ach.) M. Choisy - saxicolous, on shaded siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Amygdaloid Island, July 1984, *Wetmore 51531* (MIN); Isle Royale NP, 1 mi S of Huginnin Cove, July 1984, *Wetmore 52823* (MIN).

Psora decipiens (Hedwig) Hoffm. - terricolous, on calcareous soils; UP: 1, LP: 0.

Chippewa: Drummond Island, Maxton Plains, on soil on dolostone pavement, May 1981, *Marr 836* (MIN).

Psora globifera (Ach.) A. Massal. - terricolous, on calcareous soils; UP: 3, LP: 0.

Keweenaw: summit of bluffs at top of Mt Brockway, rock cracks, July 1976, *Imshaug 59205*.—Marquette: hills N of Mountain Lake, Sept 1949, *Imshaug 5164*.

Psorula rufonigra (Tuck.) Gotth. Schneider - lichenicolous on *Spilonema revertens*; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, on SW end of West Caribou Island, along shore, on *Spilonema revertens* on rock, July 1959, *Wetmore 4404*.

Punctelia bolliana (Müll. Arg.) Krog - corticolous, on deciduous trees; UP: 2, LP: 16.

Clinton: S side of Park Lake, *Quercus* woods, on *Quercus*, May 1972, *Harris* 7704.—Ingham: Dansville State Game Area, W of Howard Rd, *Quercus* woods, on *Quercus*, June 1972, *Harris* 7734.

Punctelia borreri (Sm.) Krog - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Punctelia hypoleucites (Nyl.) Krog - corticolous, on coniferous trees; UP: 0, LP: 5.

Benzie: Benzie State Park, forested sand dunes, on *Pinus resinosa*, July 1961, *Imshaug* 27425.—Leelanau: D. H. Day State Park, W of Glen Arbor, Sept 1962, *Harris* s.n.

Punctelia rudecta (Ach.) Krog - corticolous, on deciduous trees; UP: 16, LP: 41.

Marquette: Huron Mts, 3 km NW of Howe Lake along Lake Superior shore, *Abies balsamea*, *Tsuga*, *Betula*, and *Acer*, on *Acer*, Oct 1976, *Malachowski* 3940.—Ontonagon: Porcupine Mts, NW shore of Lake of the Clouds, *Tsuga*, *Acer*, *Betula*, and *Populus*, on *Acer*, Oct 1976, *Malachowski* 5463.

Punctelia stictica (Duby) Krog - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, cliff at SW end of Washington Island, over rock, June 1958, *Wetmore* 2135B.

Punctelia subrudecta (Nyl.) Krog - corticolous, on coniferous and deciduous trees; UP: 12, LP: 8.

Dickinson: at S end of O'Neil Lake, *Thuja-Picea* swamp, on *Picea*, Sept 1971, *Harris* 7441.—Newaygo: N side of Loda Lake, *Quercus* woods, on *Quercus*, June 1972, *Harris* 7777.

Pyrenocollema tichothecioides (Arnold) R. C. Harris - saxicolous, on inundated calcareous rocks; UP: 2, LP: 2.

Mackinac: shore of Lake Huron, W of Hessel on Mich. Hwy 134, on limestone, Sept 1966, *Harris* 1080A.—Menominee: Big Cedar River Campground, in river bed of Big Cedar River, on limestone, Sept 1965, *Harris* 749.

Pyrenopsis phaeococca Tuck. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, near Rock Harbor Lodge at site of W.S. Cooper's study, rocky shore on Rock Harbor side, June 1958, *Wetmore* 2623.

Pyrenula laevigata (Pers.) Arnold - corticolous, on smooth bark of deciduous trees; UP: 8, LP: 3.

Dickinson: NE of O'Neil Lake Campground, swamp, on *Betula alleghaniensis*, Sept 1971, *Harris* 7638.—Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug* 58959B.

Pyrenula pseudobufonia (Rehm.) R. C. Harris - corticolous, on deciduous trees; UP: 7, LP: 11.

Mackinac: junction of Prairie Creek and Route 33, Oct 1975, *Malachowski* 1638A.—Iosco: Iargo Springs, along AuSable River, in mixed hardwoods, on *Quercus rubra*, Sept 1965, *Harris* 834.

Pyrrhospora elabens (Fr.) Hafellner - lignicolous; UP: 6, LP: 3.

Baraga: Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, Sept 1972, *Harris* 8016.—Charlevoix: Beaver Island, old fields near airfield, Aug 1961, *Imshaug* 27711.

Pyrrhospora varians (Ach.) R. C. Harris - corticolous, on deciduous and coniferous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Pyxine soorediata (Ach.) Mont. - corticolous, on deciduous trees; UP: 12, LP: 18.

Baraga: Huron River, 3 km WSW of mouth of Huron River, *Abies*, *Betula*, *Pinus* forest, on *Acer*, July 1977, *Malachowski* 6388A.—Marquette: Huron Mountains, 3 km NW of Howe Lake along Lake Superior shore, *Abies balsamea*, *Tsuga*, *Betula*, and *Acer*, on *Acer*, Oct 1976, *Malachowski* 3971.

Ramalina americana Hale - corticolous, on deciduous trees; UP: 14, LP: 12.

Clare: among scattered *Pinus banksiana*, on *Populus*, May 1959, *Erbisch* 94.—Delta: Fairport, tip of Garden Peninsula, Aug 1957, *Imshaug* 20060.

Ramalina calicaris (L.) Fr. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Ramalina culbersonianum LaGreca - corticolous, on deciduous trees; UP: 1, LP: 1

Cheboygan, Mackinac (LaGreca 1999).

Ramalina dilacerata (Hoffm.) Hoffm. - corticolous, on coniferous and deciduous trees; UP: 7, LP: 9.

Cheboygan: S of Hebron Mail Rd, 2 mi N of Levering Rd, *Thuja* swamp, on *Acer rubrum*, Sept 1973, *Wang* 370.—Marquette: Huron Mountains, "Flat Rock," along Lake Superior shore, *Abies balsamea*, *Betula*, scattered *Pinus strobus*, on *Abies balsamea*, Oct 1976, *Malachowski* 3904.

Ramalina farinacea (L.) Ach. - corticolous, on deciduous trees; UP: 1, LP: 1.

Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug* 58987; Isle Royale NP, Mott Island, on *Abies grandis*, June 1957, *Wetmore* 219.

Ramalina fraxinea (L.) Ach. - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Ramalina geniculata Hook. f. & Taylor - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Ramalina intermedia (Delise ex Nyl.) Nyl. - corticolous and saxicolous, on siliceous rocks; UP: 13, LP: 9.

Chippewa: inland from lake, St. Vital Point, forest campground, on *Quercus*, Oct 1975, *Malachowski* 1402.—Mackinac: along shore of St. Martins Bay, on *Thuja*, Oct 1975, *Malachowski* 1356.

Ramalina obtusata (Arnold) Bitter - corticolous, on coniferous and deciduous trees; UP: 6, LP: 0.

Keweenaw: S of Copper Harbor, Wilderness Rd (Mandam Rd), swamp with dead *Thuja* trees and *Typha*, July 1976, *Imshaug* 58922.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on *Acer*, Oct 1976, *Malachowski* 3712.

Ramalina pollinaria (Westr.) Ach. - corticolous, on deciduous trees, and saxicolous, on siliceous rocks; UP: 4, LP: 1.

Keweenaw: S of Copper Harbor, Wilderness Rd (Mandam Rd), mixed hardwood-conifer forest, on dead tree, July 1976, *Imshaug* 58848.—Marquette: Huron Mountains, W end of Huron Mountains, on *Ulmus*, Sept 1949, *Imshaug* 5103.

Ramalina roesleri (Hochst. ex Schaerer) Hue - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Keweenaw: along shore of Lake Superior at Bear Creek, E of Bete Grise, July 1976, *Imshaug 58981*; about 200 m E of ranger station, Malone Bay, boggy area, on *Fraxinus*, June 1977, *Malachowski 5761A*.

Ramalina sinensis Jatta - corticolous; UP: 3, LP: 5.

Delta: Fairport, at tip of Garden Peninsula, on *Populus* Aug 1957, *Imshaug 20054*.—Kalkaska: near Kalkaska, on *Larix* in bog, June 1957, *Imshaug 19458*.

Ramalina thrausta (Ach.) Nyl. - corticolous and saxicolous; UP: 3, LP: 0.

Keweenaw: 3 km S of Route 41, along base of cliff on Cliff Drive, on *Acer*, June 1977, *Malachowski 5674A*; Isle Royale NP, on rocky headland of Blueberry Cove, with *Abies*, *Picea*, and *Populus*, on rock, June 1977, *Malachowski 5905A*.

Rhizocarpon badioatrum (Flörke ex Sprengel) Th. Fr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, Aug 1972, *Thomson 17326* (MIN); Isle Royale NP, Wallace Lake, July 1983, *Wetmore 47641* (MIN).

Rhizocarpon cinereonigrum Vainio - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Thomson 17289* (MIN); Isle Royale NP, Mt Franklin Trail, Aug 1972, *Thomson 17318* (MIN).

Rhizocarpon cinereovirens (Müll. Arg.) Vainio - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Lake Superior, N of Lake Desor, July 1984, *Wetmore 53082* (MIN).

Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg. - saxicolous, on siliceous rocks; UP: 5, LP: 0.

Chippewa: Drummond Island, Maxton Plains, limestone pavement, Oct 1976, *Imshaug 60136A*.—Keweenaw: High Rock Bay, on rock along Lake Superior shore, *Abies balsamea*, *Betula* and *Pinus strobus*, Oct 1976, *Malachowski 4833*.

Rhizocarpon distinctum Th. Fr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Passage Island, NE tip, July 1983, *Wetmore 47556* (MIN).

Rhizocarpon eupetraeum (Nyl.) Blomb. & Forss. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Rhizocarpon geminatum Körber - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw, Marquette: (T. Feuerer, pers. comm.).

Rhizocarpon geographicum (L.) DC. - saxicolous, on siliceous rocks; UP: 5, LP: 0.

Iron: on hillside above Paint River, near Crystal Falls, rock bluffs, Sept 1957, *Imshaug 20798*.

Rhizocarpon grande (Flörke ex Flotow) Arnold - saxicolous, on siliceous rocks; UP: 7, LP: 4.

Iron: above Paint River, near Crystal Falls, rock bluffs on hillside, Sept 1957, *Imshaug 20802*.—Marquette: Huron Mountains, Fortress, NE of Mountain Lake, Sept 1949, *Imshaug 5345*.

Rhizocarpon hochstetteri (Körber) Vainio - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Keweenaw Point, Delaware Mine, on rocks, July 1947, *Thomson 3201* (MIN); Isle Royale NP, N of Conglomerate Bay, Aug 1972, *Wetmore 20984* (MIN).

Rhizocarpon lavatum (Fr.) Hazsl. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Raspberry Island, on rocky ridge and cliffs at edge of swamp, July 1984, *Wetmore 53099* (MIN).

Rhizocarpon lecanorinum Anders - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, N side of Mt Ojibway, below tower, June 1958, *Wetmore 2323*.—
Ontonagon: Porcupine Mountains, summit of escarpment NW of Lake of the Clouds, Sept 1957, *Imshaug 20529*.

Rhizocarpon lindsayanum Räsänen - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Lake Epidote, along shore near outlet of lake, June 1958, *Wetmore 2579*; above Skadberg's House at Hay Bay, on hillside, July 1959, *Wetmore 5308*.

Rhizocarpon macrosporum Lynge - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Old Feldtman Tower, July 1983, *Wetmore 48554* (MIN).

Rhizocarpon obscuratum (Ach.) A. Massal. - saxicolous, on siliceous rocks; UP: 2, LP: 2.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore 21251* (MIN); Isle Royale NP, SE of Lookout Louise, July 1983, *Wetmore 46928* (MIN).

Rhizocarpon petraeum (Wulfen) A. Massal. - saxicolous, on calcareous rocks; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49557* (MIN).—
Ontonagon: Porcupine Mountains, on sandstone, 1923, *Darlington 216*.

Rhizocarpon polycarpum (Hepp) Th. Fr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: W end of Mt Brockway drive, on shaded trap rock, Sept 1980, *Thomson 21294*, (MIN); Isle Royale NP, SE of Lookout Louise, July 1983, *Wetmore 46917* (MIN).

Rhizocarpon submodestum (Vainio) Vainio - saxicolous, on siliceous rocks; UP: 2, LP: 2.

Keweenaw: Isle Royale NP, N of Wilson Point in Todd Harbor, in mixed woods near shore on narrow point of land with *Thuja*, July 1983, *Wetmore 48136* (MIN).

Rhizocarpon umbilicatum (Ramond) Flagey - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, N of Lake Desor at shore of Lake Superior, shore and in trees near shore, on rocks, July 1984, *Wetmore 53099* (MIN).

Rhizoplaca chrysoleuca (Sm.) Zopf - saxicolous, on siliceous rocks; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, along the shore of Blakes Point, in *Thuja*, *Abies*, *Betula* forest, on rocks, June 1977, *Malachowski 6014*; Isle Royale NP, Lake Superior side of Mott Island, June 1957, *Wetmore 232*.

Rhizoplaca melanophthalma (DC.) Leuckert & Poelt - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, on SW point of Brady Cove, in *Populus*, *Betula*, *Abies* forest, June 1977, *Malachowski 6215*; Isle Royale NP, Edwards Island, July 1983, *Wetmore 48418* (MIN).

Rhizoplaca subdiscrepans (Nyl.) R. Sant. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, SW of Saginaw Point, July 1983, *Wetmore 46951* (MIN); Isle Royale NP, Rock Harbor, E of Three-Mile Campground, July 1983, *Wetmore 47225* (MIN).

Rimelia cetrata (Ach.) Hale & Fletcher - corticolous, on deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Rimelia reticulata (Taylor) M. Choisy - corticolous; UP: 2, LP: 2.

Baraga: ca. 0.25 mi NNE of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, on *Betula alleghaniensis*, Sept 1972, *Harris 8001*.—Leelanau: near Houdek Creek at N end of Lake Leelanau, in *Thuja* bog, on *Abies*, June 1957, *Imshaug 19557*.

Rimularia caeca (Lowe) Rambold & Printzen - corticolous, on coniferous trees; UP: 2, LP: 1.

Baraga: about 0.25 mi NNE of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, on *Pinus strobus*, Sept 1972, *Harris 8035*.—Osceola: near Wagner Lake, about 7 mi S of Mio, dry *Pinus banksiana* woods, on *Pinus divaricata*, Sept 1973, *Harris 8205*.

Rimularia insularis (Nyl.) Rambold & Hertel - lichenicolous, on *Lecanora rupicola*; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, NE tip of Passage Island, July 1983, *Wetmore 47557* (MIN); Isle Royale NP, mouth of McCargo Cove, July 1983, *Wetmore 48025* (MIN).

Rinodina adirondackii H. Magn. - corticolous, on coniferous trees; UP: 1, LP: 0.

Baraga: swamp E of Sturgeon River Campground, 5 mi NE of Sidnaw, on *Thuja*, Sept 1972, *Harris 8096*.

Rinodina archaea (Ach.) Arnold - corticolous, on coniferous and deciduous trees; UP: 0, LP: 1.

Cheboygan: on *Populus* (Harris 1977).

Rinodina ascociscana Tuck. - corticolous, on deciduous trees; UP: 7, LP: 3.

Cheboygan: Burt Lake, SW of intersection of Burt Lake and Hardwood Rds, hardwoods, on *Acer saccharum*, July 1974, *Harris 8989*.—Newaygo: Dudgeon Swamp, S of One-Mile Rd, ENE of White Cloud, Oct 1972, *Harris 8170*.

Rinodina colobina (Ach.) Th. Fr. - corticolous, on deciduous trees; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, S Side of Tonkin Bay, on *Populus tremuloides*, July 1980, *Wetmore 41318* (MIN); Isle Royale NP, N of Robinson Bay, on *Populus tremuloides*, July 1983, *Wetmore 49717* (MIN).

Rinodina confragosa (Ach.) Körber - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Rinodina degeliana Coppins - corticolous, on deciduous trees; UP: 0, LP: 1.

Emmet: hardwood swamp S of Larks Lake, on *Acer rubrum*, July 1974, *Harris 8872* (MICH).

Rinodina efflorescens Malme - corticolous; UP: 3, LP: 3.

Cheboygan: 6 mi N of Wolverine, off Blueberry Rd, on *Populus grandidentata*, Oct 1974, *Wang 1211*.—Chippewa: NW end of Caribou Lake, on *Thuja*, Oct 1975, *Malachowski 1445A*.

Rinodina excrescens Vainio - corticolous, on coniferous and deciduous trees; UP: 0, LP: 1.

Cheboygan: W of Hebron Mail Rd, *Thuja* swamp, Aug 1979, *Harris 9379* (det. J. Sheard) (MICH).

Rinodina exigua (Ach.) Gray - corticolous, on deciduous trees; UP: 1, LP: 2.

Benzie: Sleeping Bear Dunes NL, Platte Point, on *Quercus rubra*, June 1987, *Wetmore 58079* (MIN).—Keweenaw: Isle Royale NP, Point Hay, on *Populus balsamifera*, July 1983, *Wetmore 49144* (MIN).

Rinodina halei H. Magn. - corticolous, on deciduous trees; UP: 2, LP: 1.

Cheboygan, Luce, Mackinac (*Harris 1977*).

Rinodina metaboliza Vainio - corticolous, on coniferous and deciduous trees; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Old Feldtman Tower, on *Populus tremuloides*, July 1983, *Wetmore 4854* (MIN).

Rinodina milvina (Wahlenb.) Th. Fr. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Government Island, Adgate Harbour, on rocks ca. 28 m from the lake, Oct 1980, *Reschke 1182* (MICH).

Rinodina oxydata (A. Massal.) A. Massal. - saxicolous, on siliceous rocks, or corticolous; UP: 0, LP: 1.

Leelanau: Sleeping Bear Dunes NL, 1 mi S of Glen Haven, farmsite, on *Prunus*, July 1987, *Wetmore 58291* (MIN).

Rinodina papillata H. Magn. - corticolous, on coniferous trees; UP: 0, LP: 2.

Iosco: Iargo Springs on AuSable River, NW of Tawas City, conifer swamp, on *Thuja*, Sept 1968, *Harris 3798*.

Rinodina polyspora Th. Fr. - corticolous, on deciduous trees; UP: 3, LP: 2.

Charlevoix: Beaver Island, Green Bay, Aug 1961, *Imshaug 27825*.—Marquette: Huron Mountains, hilltop on W side of Huron Mountains, Sept 1949, *Imshaug 4370B*.

Rinodina populicola H. Magn. - corticolous, on deciduous trees; UP: 3, LP: 3.

Alpena: 8 mi SW of Alpena, off Devil's Lake Rd, on *Populus tremuloides*, Aug 1974, *Wang 970*.—Leelanau: 3 mi E of Empire, off Echo Valley Rd, on *Populus tremuloides*, Aug 1974, *Wang 883*.

Rinodina pyrina (Ach.) Arnold - corticolous, on smooth bark of deciduous trees; UP: 1, LP: 12.

Crawford: 7 mi S of Grayling, 2 mi E of Interstate 75, on *Populus tremuloides*, July 1974, *Wang 760*.—Gratiot: 5.5 mi NW of Ithaca, County Rd 543, on *Populus tremuloides*, Sept 1974, *Wang 1037*.

Rinodina subminuta H. Magn. - corticolous, on deciduous trees; UP: 9, LP: 5.

Bay: Nigger point at Saginaw Bay, scattered trees, on *Salix*, May 1958, *Imshaug 21629*.—Keweenaw: Estivant Pines, S of Copper Harbor, virgin stand of *Pinus strobus* with *Betula* and *Acer*, on *Acer*, July 1976, *Imshaug 59126B*.

Rinodina tephrae (Tuck.) Herre - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Raspberry Island, Aug 1972, *Wetmore 20993* (MIN).

Rinodina turfacea (Wahlenb.) Körber - corticolous, also on humus-rich soil and plant debris; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Todd Harbor, Wilson Point, on *Thuja*, July 1983, *Wetmore 48073* (MIN); Isle Royale NP, SE of Washington Harbor, on *Acer saccharum*, July 1984, *Wetmore 52190* (MIN).

Ropalospora chlorantha (Tuck.) S. Ekman - corticolous, on deciduous trees; UP: 1, LP: 1

Mackinac: Mackinac Island, vicinity of Fort Holmes, on *Fagus*, June 1961, *Imshaug 27253*.

Sarcogyne regularis Körber - saxicolous, on calcareous rocks; UP: 2, LP: 10.

Delta: NW of Isabella, on USFS 2231 ca. 1.5 mi W of USFS 2226, limestone road ballast pit, Sept 1969, *Harris 4215*.—Mackinac: along USFS Highway 2, N of Brevoort Lake, on limestone, Sept 1966, *Harris 1067*.

†**Sarea difformis** (Fr.) Fr. - on pine resin; UP: 1, LP: 0.

Mackinac: between Cedarville and Hessel, on resin of *Pinus*, Aug 1949, *Imshaug 3610*.

†**Sarea resinae** (Fr.) Kuntze - on conifer resin; UP: 2, LP: 4.

Cheboygan: along Burt Lake, Reese's Bog, on *Larix*, June 1974, *Harris 8747*.

Schismatomma decolorans (Turner & Borrer ex Sm.) Clauzade & Vezda - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Brady Cove, on *Thuja*, July 1983, *Wetmore 47972* (MIN).

Schismatomma pericleum (Ach.) Branth & Rostrup - corticolous, on coniferous and deciduous trees; UP: 3, LP: 0.

Delta, Gogebic, Mackinac (MICH) (Harris 1977).

Scoliciosporum chlorococcum (Stenh.) Vezda - corticolous, on deciduous trees; UP: 9, LP: 41.

Ingham: MSU Campus, N edge of Baker Woodlot, on *Acer saccharinum*, Apr 1974, *Harris 8651*.—Oscoda: E of Wagner Rd, about 7 mi S of Mio, *Pinus banksiana* woods, on *Prunus*, Sept 1973, *Harris 8335*.

Scoliciosporum umbrinum (Ach.) Arnold - saxicolous, on siliceous and calcareous rocks; UP: 5, LP: 20.

Huron: Lake Huron, Point Aux Barques, Eagle Bay, sandstone quarry, May 1958, *Imshaug 21547*.—Roscommon: SW part of county, *Pinus banksiana* woods, May 1958, *Imshaug 21331*.

Solorina saccata (L.) Ach. - terricolous, on calcareous soils; UP: 4, LP: 1.

Keweenaw: Isle Royale NP, along Lake Superior shore of John's Island, June 1958, *Wetmore 2068*.—Marquette: N shore of Presque Isle Point, N of Marquette, on soil, Sept 1949, *Imshaug 5403*.

Solorina spongiosa (Ach.) Anzi - terricolous, on calcareous soils; UP: 2, LP: 0.

Alger: Pictured Rocks NL, Munising, Miners Falls, mossy rocks wet by spray, June 1933, *Lowe 1674A* (MICH).—Marquette: Huron Mountain Club, on vertical sandstone point, N exposure, exposed to wind, rain, and waves, but not direct sun, May 1955, *Manierre L2* (MICH).

***Sphinctrina anglica** Nyl. - lignicolous, and on *Lecanora* spp.; UP: 1, LP: 2.

Keweenaw: Isle Royale NP, W end of Minong Ridge Trail, on *Thuja* snag, July 1984, *Wetmore 52378* (MIN).—Leelanau: Sleeping Bear Dunes NL, Good Harbor Bay, Shalda Creek, on *Pinus banksiana*, July 1987, *Wetmore 58565* (MIN).

***Sphinctrina leucopoda** Nyl. - on *Lecanora* and *Pertusaria* spp.; UP: 2, LP: 0.

Baraga: E of Sturgeon River Campground, 5 mi NE of Sidnaw, *Pinus-Populus* woods, on thallus of *Pertusaria macounii*, Sept 1972, *Harris 7930B*.—Keweenaw: Windigo, 2 mi NE of Windigo on Windigo Mine Trail, [lichenicolous] on *Thuja*, June 1958, *Wetmore 1813B*.

***Sphinctrina turbinata** (Pers.) De Not. - on *Opegrapha* and *Pertusaria* spp.; UP: 3, LP: 0.

Alger: Pictured Rocks NL, 0.5 mi SSW of Miners Castle Point, July 1987, *Wetmore 59590* (MIN).—Keweenaw: Isle Royale NP, E of Rainbow Cove, [lichenicolous] on *Thuja*, July 1984, *Wetmore 51911* (MIN).

Spilonema revertens Nyl. - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Capt. Kidd Island, July 1959, *Wetmore 4718* (MIN); Isle Royale NP, Hawk Island, July 1984, *Wetmore 53250* (MIN).

Staurothele areolata (Ach.) Lettau - saxicolous, on siliceous and calcareous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore 21350, 21354* (MIN).

Staurothele clopimoides (Arnold) J. Stein - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Alger: Laughing Whitefish Point, on rocks, June 1933, *Lowe 1892* (det. J.W. Thomson) (MICH).—Keweenaw: Fort Wilkins, on acid rocks above Lake Superior shore, July 1947, *Thomson 3143* (det. J. W. Thomson) (MICH).

Staurothele drummondii (Tuck.) Tuck. - saxicolous, on irrigated siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, on rock, June 1958, *Wetmore 2605*; Isle Royale NP, West Caribou Island, July 1983, *Wetmore 46674* (MIN).

Staurothele fissa (Taylor) Zwackh. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore 21345* (MIN); Isle Royale NP, outside of Locke Point, July 1983, *Wetmore 47410* (MIN).

Staurothele monicae (Zahlbr.) Wetmore - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, near Rock Harbor Lodge at site of W. S. Cooper's study, rocky shore, on rock, June 1958, *Wetmore 2625*.—Mackinac: Lake Huron shore, W of Hessel, Sept 1966, *Harris 1087*.

Steinia geophana (Nyl.) Stein. - on calcareous soils and decaying wood; UP: 0, LP: 2.

Clinton: Rose Lake Wildlife Research Area, swamp and *Sphagnum* bog near Observation Tower, May 1971, *Common* 266B.—Iosco: 4.9 mi W of Oscoda on River Rd, steep sandy banks near AuSable River, mostly *Pinus*, June 1971, *Common* 302B.

†**Stenocybe major** (Nyl.) Körber - corticolous, on bark of *Abies*; UP: 5, LP: 4.

Baraga: Sturgeon River Campground, 5 mi NE of Sidnaw, on *Abies*, Sept 1972, *Harris* 8120.—Oscoda: along E branch of Big Creek upstream from Mapes Rd, *Thuja-Picea* swamp, on dead conifer, Sept 1973, *Harris* 8349.

†**Stenocybe pullatula** (Ach.) Stein. - corticolous, on branches and trunk of *Alnus*; UP: 4, LP: 0.

Keweenaw: Isle Royale NP, 0.5 mi E of Long Point, on *Alnus*, July 1984, *Wetmore* 52662 (MIN).—Mackinac: NNW of Big Knob, on twigs of *Alnus rugosa*, May 1977, *Harris* 12244 (MIN).

Stereocaulon condensatum Hoffm. - terricolous, open sandy soils; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Stereocaulon dactylophyllum Flörke - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Passage Island, deeply shaded cliffs, on mossy rock, July 1959, *Wetmore* 5404; Passage Island, on rock cliffs (deeply shaded), July 1959, *Wetmore* 5409.

Stereocaulon glaucescens Tuck. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: W end of Huron Mountains, Sept 1949, *Imshaug* 5116, 5124.

Stereocaulon paschale (L.) Hoffm. - open heaths, among mosses; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, along trail to Lake Richie, Moskey Basin near camp, on rock, July 1957, *Wetmore* 455; Isle Royale NP, S of Moskey Basin, on rocks along top of ridge, Aug 1957, *Wetmore* 664.

Stereocaulon pileatum Ach. - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, outside of Mott Island, on rocks, June 1957, *Wetmore* 229; Isle Royale NP, Lake Superior side of Mott Island, June 1957, *Wetmore* 231A.

Stereocaulon saxatile H. Magn. - terricolous and saxicolous, on siliceous rocks; UP: 11, LP: 8.

Charlevoix: Beaver Island, Iron Ore Bay, on ground between *Juniperus*, Aug 1961, *Imshaug* 27706.—Mackinac: E of Cedarville, *Populus* woods, on pebbly soil, Aug 1949, *Imshaug* 3517.

Stereocaulon subcoralloides (Nyl.) Nyl. - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Keweenaw: Cliff Drive, 3 km S of Route 41, along base of cliff, June 1977, *Malachowski* 5678.—Marquette: Huron Mountains, Mt Ida, W side of Lake Ann, *Tsuga*, *Acer*, *Betula*, and *Pinus*, Oct 1976, *Malachowski* 4152.

Stereocaulon tomentosum Fr. - terricolous, open sandy soils; UP: 10, LP: 9

Chippewa: Munuscong State Forest, Oct 1975, *Malachowski* 1452B.—Dickinson: N of McGregor Creek, N of Ralph, old field, on soil, Sept 1971, *Harris* 7619.

Sticta beauvoisii Delise - corticolous; UP: 1, LP: 0.

Gogebic: 2 mi SE of Marenisco, on *Thuja*, July 1975, *Harris 9991* (MIN).

Sticta fuliginosa (Hoffm.) Ach. - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Hay Bay Swamp and along S side of river at end of Hay Bay, on underside of leaning *Thuja* in a wet area, June 1958, *Wetmore 2511*.

Strangospora microhaema (Norman) R. Anderson - corticolous, on deciduous trees; UP: 1, LP: 0.

Gogebic: on *Acer saccharum* (Harris 1977).

Strangospora ochrophora (Nyl.) R. Anderson - corticolous, on deciduous trees; UP: 1, LP: 1.

Cheboygan: Carp Creek, edge of the Gorge of Carp Creek, Univ. of Mich. Biological Station, on *Ulmus*, June 1967, *Harris 3616*.

Strigula stigmatella (Ach.) R. C. Harris - corticolous; UP: 7, LP: 3.

Baraga: NE of Sturgeon River Campground, 5 mi NE of Sidnaw, swamp, Sept 1972, *Harris 7831*.—
Clare: Townline Creek Swamp, ca. 2 mi N of Long Lake, on *Thuja*, June 1973, *Harris 8182*.

Strigula submuriformis (R. C. Harris) R. C. Harris - corticolous, on deciduous trees; UP: 0, LP: 1.

Washtenaw: near intersection on Bush Rd, just E of Mill Lake, on *Quercus alba*, Sept 1975, *Harris 10333* (MICH).

Teloschistes chrysophthalmus (L.) Fr. - corticolous; UP: 0, LP: 1.

Charlevoix: Beaver Island, bluff near Barney Lake, on *Picea*, Aug 1961, *Imshaug 27746*; Beaver Island, Green Bay, on *Populus*, Aug 1961, *Imshaug 27824*.

Teloschistes flavicans (Sm.) Norm. - corticolous, on deciduous trees; UP: 0, LP: 1.

Alpena: Thunder Bay (Harris 1977).

Tephromela atra (Hudson) Hafellner - saxicolous, on siliceous and calcareous rock; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Saginaw Point, July 1980, *Wetmore 41379* (MIN); Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49588* (MIN).

Thelidium minutulum Körber - saxicolous, on siliceous and calcareous rock; UP: 0, LP: 1.

Washtenaw: fields NW of Crooked Lake, *Harris s.n.*

Thelidium olivaceum (Fr.) Körber - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Chippewa: Dick State Forest Campground, NE of Trout Lake, Sept 1966, *Harris 1036C*.

Thelidium papulare (Fr.) Arnold - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S shore of Wright Island, on rock, June 1958, *Wetmore 2441A*.

Thelocarpon epibolum Nyl. - on decaying wood and peat; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Tobin Harbor, Aug 1972, *Tibell 4703* (MIN); Isle Royale NP, outside of Locke Point, July 1983, *Wetmore 47417* (MIN).

†**Thelocarpon impressellum** Nyl. - on mosses, dying lichens, decaying wood: UP: 1, LP: 0.

Mackinac: 40 mi W of St. Ignace, Aug 1977, *Wetmore 29772* (MIN).

Thelocarpon laureri (Flotow) Nyl. - terricolous and saxicolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Tobin Harbor, Hidden Lake, on bridge, July 1983, *Wetmore 49194* (MIN).

Thelopsis melathelia Nyl. - over mosses and plant debris; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Capt. Kidd Island, July 1959, *Wetmore 4716A* (MIN).

Thelotrema lepadinum (Ach.) Ach. - corticolous, on deciduous trees; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Thermutis velutina (Ach.) Flotow - saxicolous, on damp siliceous and calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Smithwick Island, June 1958, *Wetmore 1454*; Isle Royale NP, Capt. Kidd Island, rocky shore, July 1959, *Wetmore 4716A*.

Thrombium epigaeum (Pers.) Wallr. - terricolous, on mossy soils; UP: 0, LP: 2.

Crawford: Grayling, Sept 1962, *Wetmore s.n.* (MIN).—Leelanau: Sleeping Bear Dunes NL, 3.5 mi NE of Glen Arbor, July 1987, *Wetmore 58331* (MIN).

Toninia ruginosa (Tuck.) Herre - terricolous, on mossy soils; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Toninia sedifolia (Scop.) Timdal - saxicolous, on calcareous rocks and soils; UP: 2, LP: 0.

Chippewa: Prentiss Bay, along coast, on rock, Aug 1949, *Imshaug 3794*.—Mackinac: E of Cedarville, shore of Lake Huron, over rock, Aug 1949, *Imshaug 3970*.

Toninia squalida (Ach.) A. Massal. - terricolous, on calcareous soils and mosses; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Wetmore 21277* (MIN).

Toninia superioris Timdal - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Edwards Island, July 1983, *Wetmore 48492* (MIN - holotype).

Trapelia coarctata (Sm.) M. Choisy - saxicolous, on siliceous rocks; UP: 3, LP: 6.

Alger: W of Kingston Lake, open fields, Sept 1970, *Harris 6068*.—Eaton: Grand Ledge, near Fitzgerald Park, in quarry, Oct 1968, *Harris 3950*.

Trapelia involuta (Taylor) Hertel - saxicolous, on siliceous rocks; UP: 2, LP: 5.

Leelanau: Sleeping Bear Dunes NL, 2 mi S of Empire, gravel pit, June 1987, *Wetmore 57905* (MIN); Sleeping Bear Dunes NL, 1 mi S of Glen Haven, farmsite, July 1987, *Wetmore 58274* (MIN).

Trapelia placodioides Coppins & P. James - saxicolous, on siliceous and calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Mt Franklin, Aug 1972, *Wetmore 21144* (MIN); Isle Royale NP, Todd Harbor, Wilson Point, on shore, July 1983, *Wetmore 48118* (MIN).

Trapeliopsis flexuosa (Fr.) Coppins & P. James - lignicolous and corticolous; UP: 5, LP: 7.

Benzie: Sleeping Bear Dunes NL, W end of Long Lake, N of Crystal Lake, June 1987, *Wetmore 58112* (MIN).—Keweenaw: Eagle River, Cliff Mine, on log, Aug 1972, *Wetmore 20892* (MIN).

Trapeliopsis gelatinosa (Flörke) Coppins & P. James - terricolous, on humus-rich soil; UP: 1, LP: 0.

Keweenaw: Lake Superior, N side of Gay, shore of Lake Superior with low cliffs, and adjacent woods with *Sphagnum* and boulders, July 1976, *Imshaug 59172*; Isle Royale NP, SW of Feldtman Ridge (Turkey Ridge) tower along cliffs on N side of ridge, July 1959, *Wetmore 4861*.

Trapeliopsis granulosa (Hoffm.) Lumbsch - terricolous, on humus-rich soil; UP: 13, LP: 26.

Baraga: E of Sturgeon River Campground, about 5 mi NE of Sidnaw, *Pinus-Populus* woods, Sept 1972, *Harris 7946*.—Delta: Isabella, near Camp 7 lake NW of Isabella, old field, Sept 1969, *Harris 4061*.

Trapeliopsis viridescens (Schrader) Coppins & P. James - decaying wood and soil; UP: 7, LP: 4.

Baraga: Falls River, L'Anse, Sept 1949, *Imshaug 5056*.—Emmet: Wilderness State Park, Mount Nebo Trail, soil crust, June 1961, *Imshaug 27354*.

Trichothelium aeneum (Wallr.) R. C. Harris (syn. *Pseudosegidium aenea*) - corticolous, smooth bark of deciduous trees; UP: 1, LP: 0.

Keweenaw (Harris 1977).

Trypethelium virens Tuck. ex Michner - corticolous, on deciduous trees; UP: 1, LP: 11.

Charlevoix: Beaver Island, Lake Geneserath, on *Fagus*, Aug 1961, *Imshaug 27490*.—Ingham: MSU Campus, middle of Baker Woodlot, on *Fagus*, Nov 1973, *Harris 8524*.

Tuckermannopsis americana (Sprengel) Hale - corticolous, on coniferous and deciduous trees; UP: 2, LP: 0.

Alger: 2.5 km N of Little Beaver Lake Campground, beach with *Pinus strobus*, *Betula*, and *Acer*, on *Betula papyrifera*, Oct 1976, *Malachowski 3062*.—Keweenaw: Isle Royale NP, in Hay Bay swamp and along river at end of Hay Bay, on *Abies*, June 1958, *Wetmore 2492*.

Tuckermannopsis ciliaris (Ach.) Gyelnik - corticolous, on coniferous trees; UP: 15, LP: 21.

Baraga: Lake Superior, 500 m W of mouth of Huron River, sandy shore with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, on *Pinus divaricata*, July 1977, *Malachowski 6369B*.—Chippewa: 1 km W of the mouth of Tahquamenon river, in *Abies*, *Picea*, *Larix*, *Acer*, *Betula*, *Populus* forest, on a conifer, July 1977, *Malachowski 7259A*.

Tuckermannopsis fendleri (Nyl.) Hale - corticolous, on coniferous trees; UP: 0, LP: 2.

Oscoda: near Wagner Lake, ca. 7 mi S of Mio, dry *Pinus banksiana-Quercus* woods, on *Pinus divaricata*, Sept 1973, *Harris 8186A*.—Roscommon: SW portion of county, *Pinus banksiana* woods, on *Pinus divaricata*, May 1958, *Imshaug 21340*.

Tuckermannopsis orbata (Nyl.) M. J. Lai - corticolous, on coniferous and deciduous trees; UP: 2, LP: 1.

Alger: Pictured Rocks NL; Keweenaw: Isle Royale NP; Leelanau: Sleeping Bear Dunes NL (Wetmore 1997).

Tuckermannopsis sepincola (Ehrh.) Hale - corticolous, on trees and shrubs; UP: 2, LP: 0.

Chippewa: Bayview Campground, along shore of Lake Superior, in *Acer*, *Betula*, *Pinus banksiana* forest, on *Pinus divaricata*, July 1977, *Malachowski* 7268C.—Marquette: Huron Mountains, 500 m E of N end of Mountain Lake, S of Mt Stream, on log, Oct 1976, *Malachowski* 3672A.

Umbilicaria americana Poelt & T. Nash - saxicolous, on siliceous rock; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, W of Mt Ojibway, July 1983, *Wetmore* 47891 (MIN); Isle Royale NP, Net Island (NE of Amygdaloid Island), July 1984, *Wetmore* 51425 (MIN).

Umbilicaria deusta (L.) Baumg. - saxicolous, on siliceous rock; UP: 4, LP: 1.

Chippewa: E side of Big Shoal Cove, scattered *Thuja* with exposed limestone pavement and low *Juniperus*, on non-calcareous erratic, Oct 1976, *Imshaug* 59969.—Keweenaw: on Cliff Drive, 3 km S of Route 41, along base of cliff, June 1977, *Malachowski* 5656A.

Umbilicaria hyperborea (Ach.) Hoffm. - saxicolous, on siliceous rock; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, N side of Mt Ojibway, on a rock cliff, June 1958, *Wetmore* 2292B.—Marquette: Huron Mountains, hilltop on W side of Huron Mountains, Sept 1949, *Imshaug* 4400.

Umbilicaria mammulata (Ach.) Tuck. - saxicolous, on siliceous rock; UP: 3, LP: 0.

Keweenaw: Lake Superior, along survey line 125 from baseline to Lake Superior, hilly and rocky area with *Abies* and *Thuja*, next to rock outcrop, June 1968, *Erbisch* 2648.—Marquette: Huron Mountains, N end of Mountain Lake, mostly *Acer*, some *Pinus*, steep hillside, on granite cliff face, Oct 1976, *Malachowski* 3457.

Umbilicaria muehlenbergii (Ach.) Tuck. - saxicolous, on siliceous rock; UP: 3, LP: 0.

Keweenaw: 3km S of Route 41, along base of cliff on Cliff Drive, June 1977, *Malachowski* 5669.—Marquette: Huron Mountains, N end of Mountain Lake, steep rocky hillside with mostly *Acer* and some *Pinus*, on granite cliff face, Oct 1976, *Malachowski* 3569.

Umbilicaria phaea Tuck. - saxicolous, on siliceous rock; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Hawk Island, July 1984, *Wetmore* 53235 (MIN).

Umbilicaria polyphylla (L.) Baumg. - saxicolous, on siliceous rock; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Moskey Basin, at end of Rock Harbor near trail to Lake Richie, July 1957, *Wetmore* 454.

Umbilicaria torrefacta (Lightf.) Schrader - saxicolous, on siliceous rock; UP: 2, LP: 0.

Keweenaw: Mt Franklin, near Rock Harbor shore, near trail to Mt Franklin, on rock, June 1958, *Wetmore* 1688; Isle Royale NP, N side of Mt Ojibway, on rock cliff, June 1958, *Wetmore* 2292A.

Umbilicaria vellea (L.) Hoffm. - saxicolous, on siliceous rock; UP: 4, LP: 0.

Marquette: Huron Mountain, N end of Mountain Lake, steep rocky hillside with mostly *Acer* and some *Pinus*, on granite cliff face, Oct 1976, *Malachowski* 3447.—Ontonagon: Porcupine Mountains, along summit of escarpment above Lake of the Clouds, Sept 1957, *Imshaug* 20441.

Umbilicaria virginis Schaerer - saxicolous, on siliceous rock; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Usnea angulata Ach. - corticolous; UP: 0, LP: 1.

Leelanau: (Harris 1977).

Usnea cavernosa Tuck. - corticolous; UP: 13, LP: 2.

Keweenaw: along base of cliff on Cliff Drive, 3 km S of Route 41, on *Abies*, June 1977, *Malachowski* 5663; Isle Royale NP, Malone Bay, ca. 200 m E of ranger station, boggy area, on *Abies*, June 1977, *Malachowski* 5753.

Usnea ceratina Ach. - corticolous; UP: 8, LP: 1.

Marquette: Huron Mountain Club, along Salmon-Trout River, 1.2 km N of entrance to Huron Mountain Club, on *Acer*, Oct 1976, *Malachowski* 4270.—Ontonagon: Manabezno Falls, Big Presque Isle River, *Tsuga*, *Betula*, *Thuja*, and *Pinus* woods, on *Tsuga*, Oct 1976, *Malachowski* 5603.

Usnea cornuta Körber - corticolous and saxicolous; UP: 3, LP: 0.

Chippewa: bog about 1 mi E. of Mackinac Co. on Mich 134, Aug 1949, *Imshaug* 3347.—Keweenaw: Isle Royale NP, Island Mine Trail, between Island Mine and Greenstone Ridge, July 1959, *Wetmore* 4938.

Usnea diplotypus Vainio - saxicolous; UP: 2, LP: 0.

Keweenaw, Ontonagon: (P. Clerc, pers. comm.).

Usnea filipendula Stirton - corticolous; UP: 11, LP: 1.

Keweenaw: 350 m N of Mendota Canal, Bete Grise Bay, along shore of Lake Superior, *Abies*, *Betula*, and *Acer* woods, on *Acer*, Oct 1976, *Malachowski* 5027; Isle Royale NP, 100 m W of Hay Bay Campground, in *Betula-Abies* forest, on *Betula*, June 1977, *Malachowski* 5820.

Usnea fulvoreagens (Räsänen) Räsänen - corticolous; UP: 10, LP: 1.

Keweenaw: Lake Superior, 1.2 km past end of Route 41 on hill overlooking Lake Superior, in *Abies*, *Betula* woods, on *Abies*, June 1977, *Malachowski* 5711; Isle Royale NP, 100 m W of Hay Bay Campground, in *Betula*, *Abies* forest, on *Abies*, June 1977, *Malachowski* 5813.

Usnea glabrescens (Nyl. ex Vainio) Vainio ex Räsänen - corticolous; UP: 3, LP: 0.

Keweenaw: Isle Royale NP, Monkey Basin at end of Rock Harbor, on dock, July 1957, *Wetmore* 421B.—Luce: off Lake Superior near Deer Park, low dunes, on *Betula*, Aug 1957, *Imshaug* 20323C.

Usnea hirta (L.) F. H. Wigg. - corticolous and on lignum; UP: 14, LP: 20.

Alger: Kingston Lake, SW of Grand Marais, Sept 1964, *Harris s.n.*—Baraga: Lake Superior, 500 m W of mouth of Huron River, sandy shore, with *Pinus banksiana* and scattered *Acer* and *Pinus resinosa*, on *Acer*, July 1977, *Malachowski* 6363.

Usnea lapponica Vainio - corticolous; UP: 1, LP: 1.

Cheboygan: Reese's Bog, N shore of Burt Lake, on *Thuja*, July 1949, *Imshaug* 2986.—Keweenaw: Isle Royale NP, on S shore of Amygdaloid Lake on Amygdaloid Island, on *Abies*, July 1959, *Wetmore* [4661A] & Herre.

Usnea longissima Ach. - corticolous; UP: 4, LP: 0.

Keweenaw: Isle Royale NP, on S side of Chippewa Harbor, ca. 1.5 km SW of harbor mouth, in *Thuja*, *Betula*, *Abies* forest, on *Betula alleghaniensis*, June 1977, *Malachowski* 5931.—Marquette: 1.2 km N of entrance to Huron Mountain Club, along Salmon-Trout River, on *Tsuga*, Oct 1976, *Malachowski* 4232.

Usnea mutabilis Stirton - corticolous and on lignum; UP: 0, LP: 1.

Washtenaw: Ann Arbor, on fence, Nov 1895, *Johnson s.n.* (det. R. C. Harris) (MICH).

Usnea rubicunda Stirton - corticolous, on deciduous trees; UP: 1, LP: 0.

Iron: (P. Clerc, pers. comm.).

Usnea subfloridana Stirton - corticolous; UP: 12, LP: 9.

Alger: 1 km E of Hurricane River Campground along shore of Lake Superior, *Abies*, *Betula alleghaniensis*, *Acer*, and *Thuja*, Oct 1976, *Malachowski 2594*.—Keweenaw: Isle Royale NP, along shore of Duncan Bay and up hillside below Lookout Louise, on *Populus tremuloides*, July 1977, *Malachowski 6318*.

Usnea subfusca Stirton - corticolous; UP: 1, LP: 0.

Mackinac: St. Ignace, July 1909, *Wilson s.n.* (MIN).

Usnea subscrabosa Mot. - corticolous, lignicolous; UP: 1, LP: 0.

Iron, Marquette: (P. Clerc, pers. comm.).

Usnea substerilis Mot. - corticolous; UP: 3, LP: 1.

Alger, Cheboygan, Iron, Keweenaw (incl. Isle Royale), Marquette: (P. Clerc, pers. comm.).

Usnea wasmuthii Räsänen - corticolous; UP: 1, LP: 0.

Keweenaw: Isle Royale NP; Iron: (P. Clerc, pers. comm.).

Verrucaria aethiobola Wahlenb. - saxicolous, on damp siliceous rocks; UP: 2, LP: 0.

Keweenaw: Isle Royale NP, Rock Harbor, Heron Island, July 1983, *Wetmore 49563* (MIN).—Menominee: Big Cedar Campground, N of Cedar River, river bed, Sept 1965, *Harris 731B*.

Verrucaria elaeomelaena (A. Massal.) Arnold - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, SE of Huginnin Cove, on rocks in stream, July 1984, *Wetmore 52446* (MIN).

Verrucaria funckii (Sprengel) Zahlbr. - saxicolous, on damp siliceous rocks; UP: 0, LP: 1.

Benzie: Sleeping Bear Dunes NL, W end of Long Lake, N of Crystal Lake, June 1987, *Wetmore 58129* (MIN).

Verrucaria glaucovirens Grumann - saxicolous, on calcareous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Davidson Island, Aug 1972, *Thomson 72307* (MIN).

Verrucaria margacea (Wahlenb.) Wahlenb. - saxicolous, on damp siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Verrucaria muralis Ach. - saxicolous, on calcareous rocks; UP: 5, LP: 14.

Delta: Isabella, on USFS 2231 1.5 mi W of USFS 2226, NW of Isabella, limestone ballast pit, Sept 1969, *Harris 4225*.—Mackinac: along Mich. Hwy 123, S. of Ozark, shaded limestone outcrop, Sept 1966, *Harris 1073A*.

Verrucaria nigrescens Pers. - saxicolous, on calcareous rocks; UP: 3, LP: 1.

Keweenaw: Isle Royale NP (Wetmore 1997).

Verrucaria rheitrophila Zschacke - inundated rocks; UP: 1, LP: 0.

Luce: Tahquamenon River, banks of Tahquamenon River, Tahquamenon State Park, partially submerged rocks, Sept 1966, *Harris 1138, 1139*.

Verrucaria viridula (Schrader) Ach. - calcareous (? and siliceous) rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP (Wetmore 1997).

Vulpicida pinastri (Scop.) J.-E. Mattsson & M. J. Lai - corticolous, on deciduous and coniferous trees; UP: 12, LP: 10.

Chippewa: Whitefish Point, Oct 1975, *Malachowski 1526*.—Luce: Lake Superior Campground, Lake Superior State Forest, Oct 1975, *Malachowski 1608*.

Xanthoparmelia angustiphylla (Gyelnik) Hale - saxicolous, on siliceous rocks; UP: 2, LP: 0.

Baraga: along Sturgeon River upstream from bridge, 5 mi NE of Sidnaw, on rock at river's edge, Sept 1972, *Harris 8079*.—Keweenaw: High Rock Bay, along shore of Lake Superior, *Abies balsamea*, *Betula*, and *Pinus strobus* woods, on rock, Oct 1976, *Malachowski 4765*.

Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale - saxicolous, on siliceous rocks; UP: 7, LP: 0.

Chippewa: Drummond Island, E of Bruce Point, old field, Oct 1976, *Imshaug 60075*.—Marquette: Huron Mountain, N end of Mountain Lake, steep rocky hillside with mostly *Acer* and some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3460*.

Xanthoparmelia cumberlandia (Gyelnik) Hale - saxicolous, on siliceous rocks; UP: 9, LP: 6.

Cheboygan: along N side of Cheboygan Rd (old Mackinaw Rd), 9 mi ESE of Mackinaw City, on boulder in hardwood forest, June 1973, *Wang 123*.—Marquette: Huron Mountain, N end of Mountain Lake, on steep rocky hillside with mostly *Acer* and some *Pinus*, on granite cliff face, Oct 1976, *Malachowski 3502*.

Xanthoparmelia hypomelaena (Hale) Hale - saxicolous, on siliceous rocks; UP: 0, LP: 1.

Washtenaw: NE of Crooked Lake, old fields, July 1976, *Harris 11646* (MICH).

Xanthoparmelia lineola (E. C. Berry) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Marquette: Huron Mountain Club (Manierre 1999).

Xanthoparmelia mexicana (Gyelnik) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Long Island, on rock, July 1959, *Wetmore 5059*.

Xanthoparmelia plittii (Gyelnik) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 3.

Barry: W shore of Otis Lake, on small glacial erratic, July 1965, *Harris 307*.—Clinton: Rose Lake Game Area, SE of junction of Clark and Peacock Rds, on glacial erratic, Apr 1969, *Harris 3997*.

Xanthoparmelia somloënsis (Gyelnik) Hale - saxicolous, on siliceous rocks; UP: 6, LP: 0.

Chippewa: Bruce Point, old field E of Bruce Point, Oct 1976, *Imshaug 60064*.—Keweenaw: summit of bluffs at top of Mt Brockway, July 1976, *Imshaug 59215B*.

Xanthoparmelia tasmanica (Hook. f. & Taylor) Hale - saxicolous, on siliceous rocks; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, NE tip of Passage Island, July 1983, *Wetmore* 47545 (MIN).

Xanthoria candelaria (L.) Th. Fr. - corticolous and saxicolous; UP: 2, LP: 0.

Gogebic: Great Conglomerate Falls, Black River near Lake Superior, Sept 1957, *Imshaug* 20674A.—Keweenaw: Isle Royale NP, near light at Blake Point, on rocks, Aug 1957, *Wetmore* 548C.

Xanthoria elegans (Link) Th. Fr. - saxicolous, on calcareous rocks; UP: 7, LP: 2.

Emmet: Wilderness State Park, Waugoshance Point, June 1961, *Imshaug* 27311.—Keweenaw: Isle Royale NP, Hay Point, in parkland like community of *Fraxinus*, *Betula*, *Thuja*, and *Abies*, June 1977, *Malachowski* 5892.

Xanthoria fallax (Hepp) Arnold - corticolous, on deciduous trees; UP: 3, LP: 21.

Barry: near Gun Lake, on *Quercus alba*, June 1957, *Imshaug* 19783.—Chippewa: Drummond Island, along road at Drummond airport, on *Acer*, Oct 1976, *Imshaug* 60155.

Xanthoria fulva (Hoffm.) Poelt & Petutschnig - corticolous, on deciduous trees; UP: 0, LP: 2.

Eaton: Grand Ledge, S of N River Hwy, on *Quercus*, Aug 2000, *Fryday* 8005.—Ingham: 1960, *Brodo* 383 (CANL) (Lindblom 1997).

Xanthoria hasseana Räsänen - corticolous, on deciduous trees; UP: 3, LP: 4.

Berrien: Warren Dunes SP, E of beach parking lot, on *Populus deltoides*, June 1985, *Wetmore* 53841 (MIN).—Keweenaw: Isle Royale NP, Point Hay, on *Populus tremuloides*, July 1983, *Wetmore* 49171 (MIN).

Xanthoria polycarpa (Hoffm.) Rieber - corticolous, on deciduous trees; UP: 13, LP: 19.

Chippewa: along shore of Lake Superior, Bayview Campground, in *Acer*, *Betula*, *Pinus banksiana* forest, on *Populus tremuloides*, July 1977, *Malachowski* 7290B.—Keweenaw: along the shore of Blakes Point, in *Thuja*, *Abies*, *Betula* forest, on *Populus tremuloides*, June 1977, *Malachowski* 6000A.

Xanthoria sorediata (Vainio) Poelt - saxicolous, on calcareous rocks; UP: 2, LP: 0.

Keweenaw: shore of Lake Superior, Five-Mile Point, Sept 1957, *Imshaug* 20876; Isle Royale NP, along shore of Capt. Kidd Island, facing NW and exposed to Lake Superior, July 1959, *Wetmore* 4693.

Xanthoria ulophyllodes Räsänen - corticolous, on deciduous trees; UP: 1, LP: 3.

Allegan: E of Round Lake, around bog, on *Quercus*, Sept 1957, *Imshaug* 20950.—Keweenaw: Isle Royale NP, N of Conglomerate Bay, July 1983, *Wetmore* 49511 (MIN).

Xylographa disseminata Willey - on coniferous lignum; UP: 1, LP: 0.

Alger: Pictured Rocks NL, NW of Beaver Lake, at ridge, on *Pinus* stump, July 1987, *Wetmore* 59453 (MIN).

Xylographa pallelala (Ach.) Behlen & Desberger - on coniferous lignum; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, S side of Tonkin Bay, July 1980, *Wetmore* 41266 (MIN); Isle Royale NP, Rock Harbor, Heron Island, on *Thuja*, July 1983, *Wetmore* 49677 (MIN).

Xylographa vitiligo (Ach.) J. R. Laundon - on coniferous lignum; UP: 1, LP: 0.

Keweenaw: Isle Royale NP, Moskey Basin, NE side, on *Thuja*, July 1983, *Wetmore 48313* (MIN);
Isle Royale NP, N of Robinson Bay, on *Thuja* log, July 1983, *Wetmore 49688* (MIN).

EXCLUDED SPECIES

The following taxa have been recorded or reported from Michigan but are not included in the Checklist.

DUBIOUS LOCALITIES

Alectoria sarmentosa subsp. *sarmentosa* (Nyl.) D. Hawksw. - There is one luxuriant specimen in MSC, which has *Platismatia glauca* as an associated species. The collection is labelled "collected at Chatham, Mich; C. J. W. 1901," which is in Alger County. I. M. Brodo (Nov 1973) annotated the collection, "this specimen is almost certainly mislabelled. Not only is *A. sarmentosa* unknown for this area, but *P. glauca* is also very uncommon." The collection was originally determined as *Usnea longissima*, which is known from the area. It is probable that this specimen of *Alectoria sarmentosa* originated from outside the Great Lakes area and had been inadvertently switched with a specimen of *Usnea longissima* collected from Chatham.

Coenogonium interplexum Nyl. - The specimen at MICH associated with the label "*Smith, AH, s.n.*" [on old trees, Ann Arbor, July 1932] probably originated from outside Michigan. This species is otherwise known in North America from only Florida and Louisiana.

DUBIOUS DETERMINATIONS

Arthopyrenia cinereopruinosa (Schaerer) A. Massal.—A specimen in MICH from Keweenaw (Isle Royale NP) described as "like *A. lapponica*, but smaller in all respects" by Harris (1977) is probably this species.

Aspicilia calcarea (L.) Mudd—Most Michigan records appear to be referable to *A. contorta* (C. Wetmore, pers. comm.).

Bryoria lanestris (Ach.) Brodo & D. Hawksw.

Bryoria nadvornikiana (Gyelnik) Brodo & D. Hawksw.

Calicium italicum—nomen confusum.

Caloplaca cinnabarina (Ach.) Zahlbr.—Records of this species from Keweenaw (Isle Royale NP) are misidentifications (Wetmore & Kärnefelt 1999).

Cladonia subtenuis (Abbayes) Hale & Culb.

Dermatocarpon reticulatum H. Magn.

Lasallia pustulata (L.) Mérat.

Physconia enteroxantha (Nyl.) Poelt—The only Michigan records of this species are from Sleeping Bear Dunes NL. These have soredia that react weakly K+ yellow but lack a yellow medulla and soredia and are probably referable to *P. detera* (Wetmore 1988).

Physcia tribacia (Ach.) Nyl.—Two collections in MICH from Keweenaw (Isle Royale NP) and Cheboygan are probably misidentified.

Rhizocarpon concentricum (Davies) Beltr.—Records are referable to *R. obscuratum* or *R. petraeum*.

MISIDENTIFICATIONS FOR NORTH AMERICA

Anaptychia ciliaris (L.) Körber (for North America = *A. setifera*).

Arthopyrenia rhyponia (Ach.) A. Massal.

Bacidia igniarii (Nyl.) Oksner—Most North American specimens are misidentifications (Ekman 1996). The two specimens in MICH are on loan to LD, so Ekman presumably has seen these.

Bacidia incompta (Borrer ex Hook.) Anzi.

Bacidia sabuletorum (Schreber) Lettau (syn. *Mycobilimbia sabuletorum*)—This species probably does not occur in North America (Ekman 1996).

Eopyrenula leucoplaca (Wallr.) R. C. Harris.

Lecanora argopholis (Ach.) Ach. (*L. frustulosa* for North America).

- Lopadium pezizoideum* (Ach.) Körber—All records from Michigan are referable to *L. disciforme*.
Ochrolechia pallescens (L.) A. Massal.
Pertusaria pertusa (for North America = *P. consocians*).
Physconia distorta (With.) J. R. Laundon.
Physconia grisea (Lam.) Poelt.
Pyrenula nitida (Weigel) Ach.
Ramalina fastigiata (Pers.) Ach.—Most North American records are referable to *R. americana*.
Rhizocarpon plicatile (Leighton) A. L. Smith—Specimens previously placed here are referable to *R. obscuratum* or *R. rubescens*.
Sticta wiegelii (Ach.) Vainio (= *Sticta beauvoisii*).
Usnea plicata (L.) Weber.
Xanthoparmelia hypopsila (Müll. Arg.) Hale—Most specimens are *X. angustiphylla*.
Xanthoparmelia taractica (Kremp.) Hale—Specimens from eastern North America are mostly *X. somloënsis*.

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TALIPARITI (MALVACEAE), A SEGREGATE FROM HIBISCUS

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ABSTRACT. *Talipariti* is segregated from *Hibiscus* L. in generic rank and described as new. In the past it has been variously treated in sectional rank, as *Hibiscus* sect. *Azanzae* DC., or in generic rank, either under the name *Pariti* Adans. or under the name *Paritium* A. St.-Hil., both of which are illegitimate (nom. rejic.). The circumscription of the group has been narrowed over previous interpretations by the exclusion of several species that evidently have other affinities. The narrowed group is here interpreted to have 22 species, one including two varieties. One new species is proposed, *Talipariti bowersiae*. The genus is largely tropical, although one species reaches temperate climates in Japan and Korea. *Talipariti* is found in Southeast Asia, New Guinea, the Greater and Lesser Antilles, and along the coasts of Australia, India, South and Central America, and islands of the Indian and Pacific Oceans. Several species have been taken into cultivation to some extent, largely as ornamental trees or shade trees, and one species (*T. elatum*) has been the subject of plantings on a small scale for timber production.

INTRODUCTION

Hibiscus tiliaceus var. *tiliaceus* is a widespread and well-known tropical and subtropical strand species. Its natural distribution is largely Old World, on the shores of the Indian Ocean and around much of the Pacific Basin. It is also sometimes cultivated elsewhere as a shade tree or as an ornamental flowering tree. *Hibiscus tiliaceus* var. *pernambucensis* (Arruda) I. M. Johnst. is its equally abundant New World vicariad, occurring on both the Atlantic and Pacific shores of the American tropics. A small group of additional species, each of more limited distribution, centers taxonomically on these two taxa, and together they form a natural group, sometimes treated in sectional rank within *Hibiscus*, sometimes separated from *Hibiscus* and treated in generic rank. At the other extreme, these taxa are sometimes thrown together uncritically into one or a few species. Gürke (1892), for example, lumped at least four species (as recognized here) into a broadly conceived and heterogeneous *H. tiliaceus*, and Borssum Waalkes (1966) combined six species (as treated here) into one species (*H. tiliaceus*), treated as six subspecies. The index to botanical names at the end of this paper lists 19 names of infraspecific taxa in *Hibiscus tiliaceus* (including various ranks and combinations), indicating some of the past history of thinking on these plants.

Hibiscus tiliaceus and its allies are here excluded from *Hibiscus* and placed in a segregate genus comprising 22 species. Because the previously applied generic names are illegitimate, the new name *Talipariti* is proposed.

TAXONOMIC HISTORY

When recognized in generic rank, the group has been treated under either of two names, *Pariti* Adans. or *Paritium* A. St.-Hil. Nicolson et al. (1988) state that

Pariti Adans. (1763) is an illegitimate renaming of *Hibiscus* L. (1753), but this interpretation is incorrect (D. H. Nicolson, pers. comm.). In proposing the genus *Pariti*, Adanson (1763) cited three elements: 1) *Hortus Malabaricus* of Rheede (1678), vol. 1, pl. 30; 2) the name 'Bupariti,' from *Hortus Malabaricus*, vol. 1, pl. 29, which was the basis for the generic name by Duhamel (1760); and 3) two species of *Hibiscus*, numbers 3 and 4, from Linnaeus's *Species Plantarum* (1753: 694). These two Linnaean species are 3. *H. populneus* L. and 4. *H. tiliaceus* L.; for the former, Linnaeus cited Rheede's plate 29 and for the latter Rheede's plate 30. Adanson therefore did not rename the genus *Hibiscus*, but rather selected two of Linnaeus's 20 species of *Hibiscus* and proposed them to be a segregate genus. The name *Thespesia* Sol. ex Corrêa has been conserved over *Bupariti* Duhamel. The species depicted in Rheede's plate 29 is now recognized as *Thespesia populnea* (L.) Sol. ex Corrêa. The plant shown in plate 30 is *Hibiscus tiliaceus* L.

Duhamel (1760) published the generic name *Bupariti*, taking the name directly and explicitly from the vernacular name given by Rheede (1678). In addition to citing Rheede's description of 'Bupariti,' he also cited Linnaeus's polynomial phrase name for *Hibiscus populneus* L., which is therefore the type of the generic name *Bupariti*.

Three years later, Adanson (1763) published the generic name *Pariti*, citing in the synonymy *Bupariti* Duhamel. Thus, Adanson's name is a nomen superfluum, and it has the same type (*Hibiscus populneus*) as the name that he should have adopted, viz. *Bupariti*. Thus, both *Bupariti* and *Pariti* are homotypic synonyms of *Thespesia*, which is conserved over *Bupariti*.

St.-Hilaire (1828) proposed the name *Paritium* as an orthographic variant of *Pariti*, which he cited in synonymy. Thus it, too, has the same type as both *Pariti* and *Bupariti*, and it, too, must be rejected against the conserved *Thespesia* (ICBN, Art. 14.4). Therefore, none of the generic names that have been applied to the species under discussion here are in fact applicable, except *Hibiscus* itself if one chooses to retain them within this heterogeneous assemblage. The sectional name, *Hibiscus* sect. *Azanzae* DC., cannot be elevated to generic rank because it would then become a later homonym of the name *Azanza* Alef. (Bot. Zeit. 19: 298. 1861), which is typified by *Azanza lampas* (Cav.) Alef. [= *Thespesia lampas* (Cav.) Dalzell & Gibson].

Britton's (1918) lectotypification of *Pariti* with *Hibiscus tiliaceus* is therefore in error, and St.-Hilaire's establishment of *Paritium* on the basis of the single species *Hibiscus tiliaceus* is also in error, since both are typified by *Hibiscus populneus*, which is the type of *Thespesia* by conservation. Since none of the generic names here cited can be applied to the group discussed, a new name is required and is supplied here, taken from the vernacular name 'Talipariti' of Rheede's (1678) reference to his plate 30, headed 'Pariti, seu Tali-Pariti.'

The etymology of the name is found in Nicolson et al. (1988). 'Pariti' "is a general reference to *Hibiscus*," and the prefix 'Tali-' "means slimy and bark strips contain mucilage [and are] used by native women for shampoo."

Subsequent authors who have treated these species as generically distinct from *Hibiscus* have either used the name *Pariti* (e.g., Britton 1918; Britton & Millspaugh 1920; Britton & Wilson 1924; Williams & Cheesman 1929; Small 1933; Gooding et al. 1965; Airy-Shaw 1966; Dandy 1967) or they have used the name *Paritium* (e.g., Wight & Arnott 1834; Walpers 1842; Gray 1854; Grisebach 1859;

Baillon 1875; Eggers 1879; Hillebrand 1888; Duss 1897; Questel 1941). Similarly, those authors who have retained the species in *Hibiscus* have cited synonyms either as in *Pariti* (e.g., Kearney 1955; Correll & Correll 1982; Proctor 1984; Nicolson et al. 1988) or as in *Paritium* (e.g., Steudel 1841; Bentham & Hooker 1863; Seemann 1865–1873; Hooker 1872; Boldingh 1909; Urban 1910, 1920; Ewart & Davies 1917; Ridley 1922; Sauget & Liogier 1953; Bates 1965; Walker 1976; Fournet 1978; Sivarajan & Pradeep 1996). Only Kearney (1951) and Hutchinson (1967) have cited both *Pariti* and *Paritium* as synonyms of *Hibiscus*. Hooker and Arnott (1841) equivocally include these species sometimes in *Hibiscus*, sometimes in *Paritium*. Numerous other authors have included them in *Hibiscus* without the citation of synonyms. Nevertheless, there is clearly a strong sentiment for segregating this group from *Hibiscus*, but divided opinion on whether to use the name *Pariti* or the name *Paritium*; recent authors favored the name *Pariti*, earlier authors tended to use *Paritium*. As shown above, neither name can be used.

Mabberley (1987) and Wielgorskaya (1995), presumably following *Index Nominum Genericorum*, state that *Pariti* is the same as (i.e., a synonym of) *Thespesia* but give no explanation; however, the line of reasoning elaborated above justifies this position.

There remains the question of the gender of the generic name. Adanson did not indicate the gender of *Pariti*. According to Art. 62.3 (ICBN), its gender is that indicated by the “next subsequent author” who used the name and who must be followed. In the present case, this would evidently be Voigt (1845), who treated the name *Pariti* as neuter. Since the name *Talipariti* is etymologically equivalent to the name *Pariti*, this precedent will be followed and *Talipariti* is also treated as neuter.

Candolle’s conception of *Hibiscus* sect. *Azanzae* was broadened by Hochreutiner (1900) to include other species in addition to those that pertain to the group discussed here. Borssum Waalkes (1956, 1966) also included species of *Hibiscus* sect. *Azanzae* that do not pertain to the genus *Talipariti* (see below). The type of *Hibiscus* sect. *Azanzae* (*Hibiscus azanzae*) is a synonym of *Talipariti elatum*, so that sect. *Azanzae* is correctly a synonym of the genus *Talipariti*, though with a narrowed circumscription.

Borssum Waalkes (1956) described a number of new species of *Hibiscus* and placed them in *H.* sect. *Azanzae*. On the basis of the descriptions and illustrations, some of these can be recognized as belonging to *Talipariti*, others are probably to be excluded. Clearly included in *Talipariti* on the basis of the nature of the stipules and stipule scars are *H. aruensis*, *H. borneensis*, *H. leeuwenii*, *H. fluminis-idenburgii*, *H. archboldianus*, *H. lepidotus*, and *H. pseudotiliaceus*; *H. ellipticifolius* has the distinctive calyx nectaries, as well as the characteristic stipules. Although these prominent nectaries are curiously not mentioned in the original description, they are later noted by Borssum Waalkes (1966) as characteristic of *H. ellipticifolius*.

Other species included by Borssum Waalkes in *Hibiscus* sect. *Azanza* (Borssum Waalkes 1966) are here excluded from *Talipariti* and are omitted from the present treatment. These are *Hibiscus carrii* Borss. Waalk. (type: Carr 13219, A! L! NY!), *Hibiscus floccosus* Masters (type: Maingay 216, GH! K! L!), *Hibiscus sciadolepidus* (Hochr.) Borss. Waalk. (type: Janowsky 402, L!), *Hibiscus pulvinulifer* Borss. Waalk. (type: Docters van Leeuwen 9280, A! K! L!), *Hibiscus decaspermus* Koord. & Valetton (type: Koorders 4561, K! L!), and *Hibiscus teijsmannii* Borss. Waalk. (type: Teijsmann 12597, L!), all of which appear to have other affinities.

DELIMITATION OF TALIPARITI

The salient distinguishing features of *Talipariti* include the following characteristics.

1) Large, often more or less oblong stipules (Figs. 1, 5), pairs of which enclose and conceal the developing terminal bud, but which are deciduous, leaving characteristic annular scars. The nature of the stipules (form and placement) and of their scars is virtually diagnostic. They reach their most developed (exaggerated) form in *T. macrophyllum* (Fig. 1a), sometimes reaching a size of 11 cm long and 3 cm wide in this species.

2) Calyx lobes with nectaries on the midribs (Figs. 2i, 5b), present in some (but not all) species of *Talipariti*. Nectaries on the calyx lobes are otherwise unknown in the Malvaceae, with the exception of most species of *Hibiscus* sect. *Furcaria* DC., a group that is evidently not allied to and which cannot be confused with *Talipariti*.

3) Distinctive fruit structure (a 5-valved capsule with "false dissepiments" that make it seem imperfectly 10-loculed). Borssum Waalkes (1956) notes that some species (e.g., *T. dalbertisii*) possess these false dissepiments and other species (e.g., *T. macrophyllum*) do not. Further studies of comparative anatomy (especially of the development of the false dissepiments) of the fruit structure in *Talipariti*, as compared to other representatives of *Hibiscus* sens. lat., are warranted to evaluate the significance of capsule structure in defining *Talipariti*. Observations of several of the species with mature fruits, however, indicate that the 5-valved capsules at maturity have endocarps that separate from the exocarp and maintain their integrity as two separate halves. Thus, a mature 5-valved capsule may appear to be 10-valved and is sometimes so described in the literature. In my opinion, the fruits of *Talipariti* are uniformly 5-carpelled, as is true of the entire tribe Hibisceae (with the rarest of exceptions), and that those descriptions of species of *Talipariti* that say "10-carpelled" are in error.

4) Some species have a gamophyllous, cupuliform involucl with numerous dentate or lanceolate teeth, the involucl generally shorter than the calyx but occasionally subequal to the calyx (Fig. 2a, 2d-j). This character is distinctive of many species of *Talipariti*, but other species (especially those from New Guinea) have 5 to 10 distinct involucellar bracts, presumably representing a less specialized condition (Fig. 2k-r).

5) A relatively large chromosome number is characteristic, insofar as the species are known cytologically. Counts are reported in the literature (Youngman 1927; Longley 1933; Skovsted 1935, 1941; Skottsberg 1955; Pushparajan et al. 1986; Butorina et al. 1990) of $2n = \text{ca. } 80$, $2n = 90$, $2n = \text{ca. } 92$, $2n = \text{ca. } 96$, and $2n = 120$, for *T. elatum*, *T. hastatum*, and *T. tiliaceum*. Since many of these counts are unvouchered, it is not certain precisely which species was studied, but there is little doubt that all of the cited counts pertain to the genus *Talipariti*. The large number of chromosomes may be definitive, but sufficient cytological data are not yet at hand to be certain.

6) An arborescent habit, which is characteristic of but not unique to *Talipariti*, but none the less unusual in the Malvaceae.

7) Broadly ovate or elliptic leaves (lobed in *T. hastatum*) that are entire or finely denticulate, usually leathery in texture, and often bear one to several foliar nectaries on the principal veins abaxially, though these are absent or obscure in three or four species. The foliar nectaries (Fig. 5a), while characteristic of *Talipariti*,

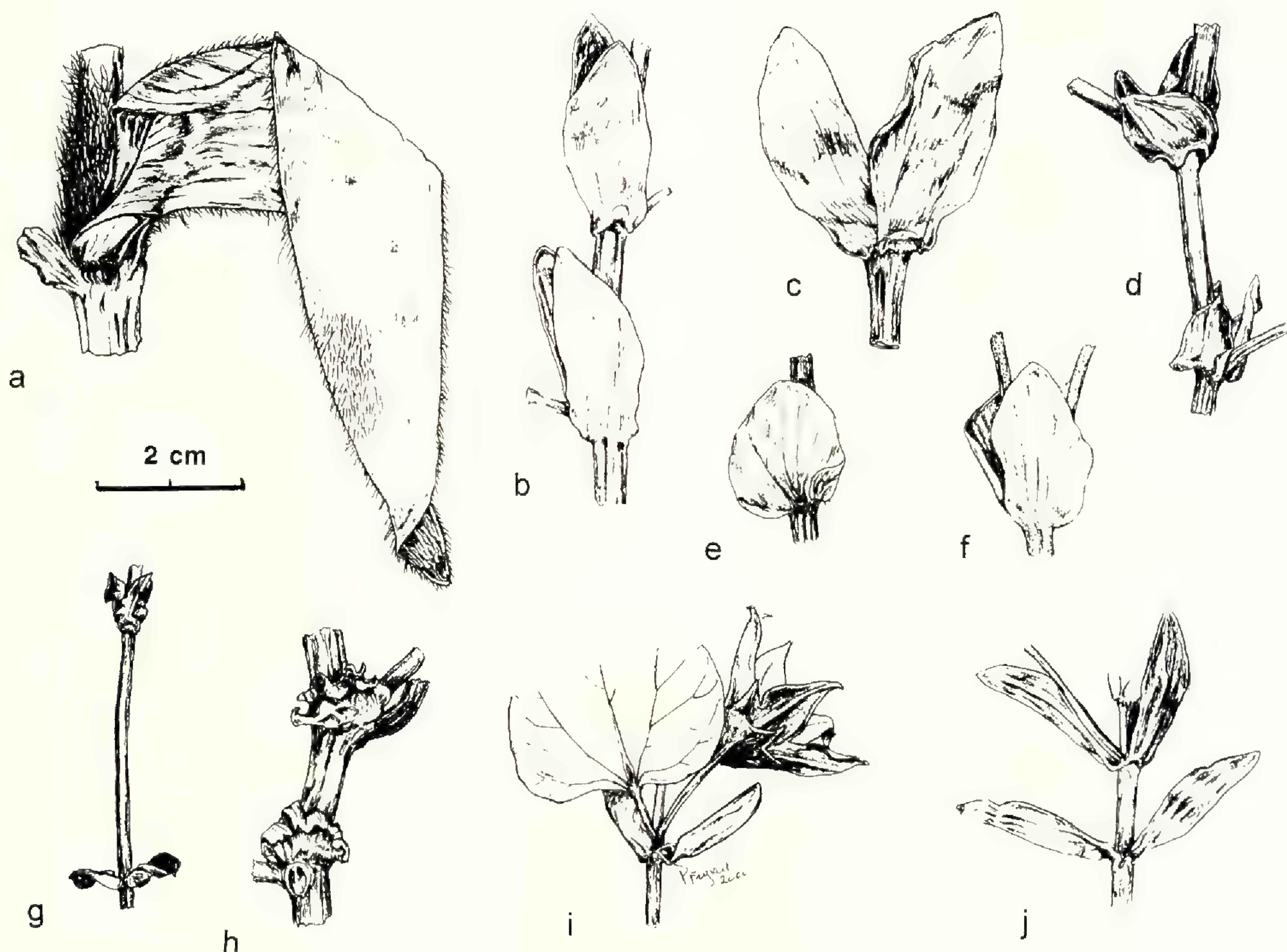


FIG. 1. Representative stipules of *Talipariti*. a. *T. macrophyllum*, the pubescence only partially indicated. b. *T. tiliaceus* var. *pernambucense*. c. *T. elatum*. d. *T. dalbertisii*. e. *T. pleijtei*. f. *T. archboldianum*. g. *T. sepikense*. h. *T. borneense*. i. *T. hamabo*. j. *T. glabrum*. Based on: a, Koorders 4577B (L); b, D'Arcy & Croat 4090 (TEX); c, Fawcett & Harris 7046 (MO); d, Schrijn 3594 (L); e, Koster 1498 (L); f, van Royen NGF-20194 (L); g, Darbyshire & Hoogland 8350 (L); h, Kostermans 6758 (L); i, Waimea Botanic Garden 74c1527 (TEX); j, Fosberg 31475 (TEX).

also occur in various other genera of Malvaceae (e.g., *Gossypium* L., *Hampea* Schldtdl., *Hibiscus*, *Kydia* Roxb., *Thespesia*, *Urena* L.) and may also be found in other families, such as Sterculiaceae (e.g., *Byttneria* Loebl.; Arbo 1972).

Other characters are less definitive, but taken together the combination of characters listed above clearly sets off *Talipariti* from other species of *Hibiscus* sensu lato. and from other members of the tribe Hibisceae (cf. Fryxell 1997). Thus, there is ample justification for recognizing *Talipariti* in generic rank. Using the criteria for recognizing segregate genera propounded by McVaugh (1945) and concisely summarized by Gillis (1971) and Grashof (1975), the recognition of *Talipariti* is generally supported by all of the eight criteria put forward by these authors.

SUBDIVISION OF TALIPARITI

It is tempting to subdivide the genus into two sections or subgenera, for those species (on the one hand) that have distinct involucellar bracts, pink or red corollas, and ferruginous-wooly seeds in contrast to those species (on the other hand) that have gamophyllous (toothed) involucels, yellow corollas, and short-pubescent to subglabrous seeds. These two groups of species, moreover, seem also to have geographical integrity as well. However, there are exceptions to this pattern



FIG. 2. Involucel and calyx of *Talipariti*. a. *T. elatum* in anthesis. b. *T. elatum*, post-anthesis, showing dehiscence of involucel and calyx as a unit. c. *T. macrophyllum*, post-anthesis. d. *T. simile* in fruit. e. *T. hastatum* in fruit. f. *T. celebicum* in fruit. g. *T. hamabo* in fruit. h. *T. glabrum* in fruit. i. *T. tiliaceum* in fruit. j. *T. potteri* in fruit. k. *T. crestaense* in bud. l. *T. sepikense*, pre-anthesis. m. *T. pleijtei* in fruit. n. *T. pseudotiliaceum*, post-anthesis. o. *T. ellipticifolium*, pre-anthesis. p. *T. aruense* in flower. q. *T. dalbertisii*, post-anthesis. r. *T. archboldianum* in anthesis. Based on: a, Lundell 16975 (LL); b, Wetmore & Abbe 757 (A); c, Griffith 477 (GH); d, Hort. Bogor. 47 (TEX); e, MacDaniels 1697 (TEX); f, Koorders 17019b (L); g, Waimea Bot. Gard. 74c1527 (TEX); h, Fosberg 31505 (TEX); i, Fosberg 26682 (US); j, Degener 23758 (US); k, Ramos 76992 (K); l, Darbyshire & Hoogland 8234 (K); m, Kalkman 6310 (K); n, Tangkilianian 229 = Kostermans 33899 (L); o, Hoogland 4880 (L); p, Brass & Versteegh 13126 (L); q, Ridsdale et al. NGF-31960 (K); r, Brass 7092 (L).

(notably *T. celebicum*, *T. macrophyllum*, and *T. pseudotiliaceum*) that indicate that this simple dichotomy is not tenable in our present state of knowledge. In addition, the interpretation of *T. simile* as a hybrid between *T. macrophyllum* and *T. tiliaceum* (see below) indicates that the apparent subunits are not very widely separated genetically. Therefore, no subdivision of the genus *Talipariti* is proposed here.

GENERIC AFFINITIES

The generic affinities of *Talipariti* are largely speculative at the present time. The genus was segregated from a broadly conceived *Hibiscus*, but its phylogenetic affinities are perhaps to be sought elsewhere. The strong morphological similarity between *Talipariti schlechteri* and *Wercklea woodsonii* (A. Robyns) Fryxell (see below) suggests a possible tie between these two genera (cf. Fryxell 1981). Shared characters include large foliaceous stipules, the arborescent habit, possibly similar (large) chromosome numbers, and to a lesser degree the elongated, ligneous pedicels (of *T. schlechteri* and *T. glabrum*) and the pentangular capsules (of *T. bowersiae* and *T. leeuwenii*), both characteristic of most species of *Wercklea* Pittier & Standl. Differences between these two genera include the absence of both foliar and calyx nectaries in *Wercklea*; the different form, placement, and persistence of the stipules in the two genera; and the frequent presence of thorns in *Wercklea* and their absence in *Talipariti*. As stated, this connection of *Talipariti* and *Wercklea* is largely speculative, but noting it may give direction to future phylogenetic studies.

TAXONOMY

Talipariti Fryxell, gen. nov.—TYPE: *Talipariti tiliaceum* (L.) Fryxell [basionym: *Hibiscus tiliaceus* L.].

Hibiscus sect. *Azanzae* DC., Prodr. 1: 453. 1824, non *Azanza* Alef., Bot. Zeit. 19: 298. 1861.—TYPE: *Hibiscus azanzae* DC. [= *Talipariti elatum* (Sw.) Fryxell.

Arbores 3–50 m altae; laminis foliorum plerumque late ovatis (rare ellipticis vel plus minusve lobatis) saepe nectariis foliorum; stipulis prominentibus sessilibus atque amplexicaulibus, ad caulis adpressis et gemmam includentibus, deciduis cicatricibus annularibus relictis; pedicellis saepe solitariis interdum in sympodiis; involu-cellis aut gamophyllis atque cupuliformibus aut 5–10 bractearum distinctorum; calyce 5-lobato, costis loborum interdum nectariis centralis; corolla campanulata ampla et speciosa, lutea vel rosea vel rubra, centro obscuro praesenti vel carenti; fructibus capsularis dehiscentibus ovoideis vel subglobosis dense pubescentibus; seminibus per loculum duabus vel aliquot pubescentibus vel glabris ut videtur.

Trees (rarely shrubs) 3–50 m tall, the trunks erect or spreading, sometimes angularly branched, the twigs minutely lepidote, puberulent, stellate-pubescent, or with long simple hairs, often glabrescent. Leaf blades often coriaceous, sometimes discoloured, ovate (rarely elliptic or obovate, sometimes deeply lobed in *T. hastatum*), basally rounded to deeply cordate (rarely cuneate), apically acute or short-acuminate, the margins usually entire (or sometimes obscurely crenulate or denticulate), palmately (or sometimes pedately) nerved, sometimes with one or more nectaries on the abaxial side of the nerves (nectaries usually solitary near

base of blade or less commonly several, more distally placed, sometimes absent); petioles usually shorter than (rarely subequal to) the blade, with pubescence similar to that of the young branches although sometimes denser; stipules prominent, lance-ovate to oblong (rarely subfalcate or suborbicular), from 0.5–3 cm long to as much as 11 cm long in *T. macrophyllum*, sessile and amplexicaul at shoot apex (appressed to stem and enclosing the terminal bud), variously pubescent to glabrescent, rarely spreading or somewhat reflexed, usually early deciduous, leaving prominent annular scars. Pedicels solitary in the upper leaf axils, usually stout and relatively short (rarely exceeding the petioles, except much longer than the petioles in *T. glabrum* and *T. schlechteri*), sometimes aggregated terminally or on short side-branches in few-flowered (or up to 9-flowered in *T. potteri*) sympodial inflorescences; involucler either gamophyllous and cupuliform with 8–12 (or more) dentate or lanceolate teeth or of 5–10 distinct elements, each ligulate to lanceolate to cordate-ovate; calyx 5-lobed (ca. half-divided or sometimes deeply divided), the lobes often costate, more or less plicate in bud distally, with or without a nectary on the midrib of each lobe; corolla campanulate (reflexed in *T. borneense*), usually large and showy, yellow (with or without a purplish center), white, rose-pink, red, or purplish (sometimes changing color on falling, e.g., yellow to orange or red); staminal column included within corolla, basally pubescent (sometimes densely lanate forming a cushion) or glabrous, antheriferous distally or throughout length, apically 5-dentate; styles emergent from the staminal column, distally distinct, sometimes pubescent, the 5 stigmas capitate or obliquely capitate, sometimes purplish. Capsules subglobose or ovoid (rarely obovoid), externally densely pubescent (the hairs often yellowish, lepidote, stellate, or simple, sometimes in combination), internally glabrous or sometimes densely wooly, 5-locular but sometimes apparently 10-locular as a result of the presence of false papery dissepiments; seeds 2 to many per carpel, reniform, 3–5 mm long, densely pubescent to seemingly glabrous (though minutely papillate or scabridulous).

The species of *Talipariti* seem to be flowering and fruiting in all months of the year, although data is scant for several species. Only for *T. hamabo* and perhaps for *T. ellipticifolium* is a clear seasonal pattern evident.

KEY TO THE SPECIES OF TALIPARITI

1. Plants prominently shaggy-hirsute, especially the young growth, the yellowish hairs 5–8 mm long; leaves large (to 40 cm long, 50 cm wide) with distally positioned nectaries on the principal veins beneath; stipules 3–11 cm long, 1.5–3 cm wide. 14. *T. macrophyllum*.
1. Plants glabrous to pubescent or lepidote, the hairs less than 1.5 mm long; leaves sometimes to 30 cm wide but usually smaller with nectaries basally positioned or absent (except distally positioned in *T. simile*); stipules 1–3 cm long, 0.4–1.8 cm wide.
 2. Involucellar bracts 5–10, distinct or nearly so, sometimes more or less revolute laterally toward base.
 3. Corolla yellow with a red center or “pale yellow and peach”; involucellar bracts 5–10, ligulate to narrowly ovate, not revolute; leaf blades to 10 cm long.
 4. Young stems sparsely pubescent to glabrescent; leaf blades about as wide as long; involucellar bracts 7–10; corolla bright yellow with a crimson center. 22. *T. tortuosum*.
 4. Young stems densely ferruginous-puberulent; leaf blades longer than wide; involucellar bracts 5–8; corolla “pale yellow and peach”. 4. *T. bowersiae*.
 3. Corolla white or violet; involucellar bracts 8–10, narrowly ovate or cordate-lanceolate and more or less revolute laterally toward base (Fig. 2p); leaf blades 8–20 cm long.
 5. Leaf blades 8–13 cm long, longer than wide, the foliar nectary elongate (13–20 mm long); petioles 3.5–6 cm long; stipules minutely puberulent; staminal column 5–8 cm long, subequal to petals, the filaments 5–7 mm long; petals violet, not reflexed. 2. *T. aruense*.

5. Leaf blades 12–20 cm long, somewhat wider than long, the foliar nectary absent; petioles 10–15 (–20) cm long; stipules roughly pubescent, the hairs to 1 mm long; staminal column 3 cm long, shorter than petals, the filaments ca. 2 mm long; petals white (but drying “greenish white tinged with pink”), reflexed. 3. *T. borneense*.
2. Involucellar bracts 5–8 and distinct, or gamophyllous and forming a cupuliform structure with 8–12 (or more) teeth.
6. Involucellar bracts distinct or nearly so, 5–8, lanceolate or cordate-ovate; foliar nectaries present or absent; corolla pink or red to purple (except yellow in *T. pseudotiliaceum*).
7. Foliar nectaries absent; petals yellow, rose-pink, or red.
 8. Petals yellow, 5 cm long; calyx 2–3 cm long. 17. *T. pseudotiliaceum*.
 8. Petals rose-pink or red, 9–10 cm long; calyx 3–4 cm long.
 9. Herbage minutely lepidote; staminal column shorter than the petals, the filaments 2–4 mm long; capsules lepidote-pubescent; calyx nectaries absent. 1. *T. archboldianum*.
 9. Herbage stellate-pubescent; staminal column subequal to petals, the filaments 4–8 mm long; capsules strigose-pubescent; calyx nectaries present. 7. *T. dalbertisii*.
7. Foliar nectaries present; petals pink or red to purple.
 10. Petals 7–8 cm long; involucellar bracts lanceolate, 3–5 mm wide, narrowed at the base, more or less reflexed (Fig. 2o). 9. *T. ellipticifolium*.
 10. Petals 2.5–4 cm long; involucellar bracts cordate-ovate, 3–20 mm wide, not reflexed.
 11. Involucel 2.5–3 cm long; calyx 2.5–5.5 cm long; staminal column (not seen) pubescent at base but presumably not forming a cushion.
 12. Pedicels 1–4 cm long; calyx 2.5–3 cm long; fruits 3 cm long; involucel subequal to calyx. 13. *T. leeuwenii*.
 12. Pedicels 10–14 cm long; calyx 5–5.5 cm long; fruits 4–4.5 cm long; involucel shorter than calyx. 18. *T. schlechteri*.
 11. Involucel 0.5–1.2 cm long; calyx 1.2–1.6 cm long; staminal column densely lanate at base (at juncture with petals), forming a cushion.
 13. Petals pink, 3–4 cm long; involucel 5–7 mm long; stipules (Fig. 1g) ovate, 7–10 mm long, 5–8 mm wide. 19. *T. sepikense*.
 13. Petals red to purple, 2.5–3 cm long; involucel 8–12 mm long; stipules (Fig. 1e) oblong to subrotund, 10–25 mm long, 5–18 mm wide. 15. *T. pleijtei*.
6. Involucellar bracts gamophyllous, forming a cupuliform structure with 8–12 (or more) triangular or lanceolate teeth (Fig. 2d–j); foliar nectaries usually present; corolla yellow, often with a dark red center.
 14. Staminal column 7–8 cm long; calyx and involucel abscissing circumscissily post-anthesis (Fig. 2b); calyx 3–5 cm long; petals 7–12 cm long, about twice (or more) as long as wide. 8. *T. elatum*.
 14. Staminal column 1–3.5 cm long; calyx and involucel persistent in fruit; calyx 1–3 cm long; petals 3–7 cm long, 1–1.5 (–2) times as long as wide.
 15. Foliar nectaries distally placed (1/3–2/3 distance from base of blade to apex). 20. *T. simile*.
 15. Foliar nectaries basal (i.e., near attachment of petiole) or absent.
 16. Leaf blades 6.5–30 cm long, 4.5–30 cm wide; calyx 10–20 mm long.
 17. Flowers solitary in the leaf axils; calyx 10–12 mm long; involucel not reflexed (Fig. 2f); seeds densely woolly with ferruginous hairs ca. 2 mm long; maximum size of leaf blades to 30 cm long and wide. 5. *T. celebicum*.
 17. Flowers borne on extended sympodia; calyx 18–20 mm long; involucellar teeth more or less reflexed in fruit (Fig. 2j); seeds appearing glabrous but actually minutely papillate; leaves to 17 cm long and 22 cm wide. 16. *T. potteri*.
 16. Leaf blades 17 cm long and 12 cm wide, or smaller; calyx 15–28 mm long.
 18. Base of leaf blade truncate to cuneate; leaf blades unlobed (and narrowly lanceolate or ovate) to prominently 3-lobed, the lobes triangular-acute; flowers often borne on extended sympodia. 12. *T. hastatum*.
 18. Base of leaf blade rounded to cordate; leaf blades unlobed, usually broadly ovate (or obovate in *T. hamabo*), acute or acuminate; flowers usually solitary in the leaf axils.

- 19. Leaf blades 10 cm long or less, basally rounded to cordate.
- 20. Pedicels (in fruit) 5–7.5 cm long (Fig. 2h); leaf blades basally rounded or shallowly cordate, glabrous beneath, ovate, acute or acuminate; stipules glabrous, with contrasting white margins; Bonin Islands. 10. *T. glabrum*.
- 20. Pedicels (in fruit) 0.3–1.2 cm long; leaf blades basally cordate, pale puberulent beneath, obovate (broadest above the middle), acuminate; stipules externally pubescent, the margins not contrastingly colored; Japan, Korea, cultivated elsewhere. 11. *T. hamabo*.
- 19. Leaf blades often more than 10 cm long, basally rounded to deeply cordate.
- 21. Leaf blades basally rounded to shallowly cordate, ovate to oblong-elliptic or somewhat obovate, 3–9 cm wide; foliar nectaries absent; seeds pubescent. 6. *T. crestaense*.
- 21. Leaf blades deeply cordate, broadly ovate, usually 10 cm wide or more; foliar nectaries present; seeds minutely papillate (Fig. 5e). 21. *T. tiliaceum*.

1. *Talipariti archboldianum* (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus archboldianus* Borssum Waalkes, Reinwardtia 4(1): 59, fig. 9. 1956.—TYPE: NEW GUINEA. [PAPUA NEW GUINEA. Western:] Palmer River, 2 mi below junction of Black River, 100 m, Jun 1936, *Brass* 7092 (holotype: BO; isotypes: A! BM, L!).

Hibiscus womersleyanus Borssum Waalkes, Reinwardtia 4(1): 61, fig. 10. 1956.—TYPE: NEW GUINEA. [PAPUA NEW GUINEA. Madang:] “Central Highlands District,” Aiyura, 1800 m, 25 Nov 1950, *Womersley-NGF* 3386 (holotype: LAE; isotypes: A! BO, BRI, L! SING; photo of K isotype: TEX!).

Hibiscus lepidotus Borssum Waalkes, Reinwardtia 4(1): 63, fig. 11. 1956.—TYPE: NEW GUINEA. [PAPUA NEW GUINEA. Central:] Mt. Tafa, sheltered valley forests, 2400 m, *Brass* 4950 (holotype: BO; isotypes: A! BM, BRI).

Figs. 1f, 2r.

Trees 8–50 m tall, the twigs minutely and sparsely lepidote, the scales ca. 0.1 mm in diameter. Leaf blades ovate, [5?–] 14 cm long, [4?–] 11 cm wide, basally rounded to subcordate, the margin entire, apically acuminate, palmately 7-nerved, sparsely and minutely lepidote-pubescent on upper surface (especially along veins), more densely so on lower surface, slightly discolored, lacking foliar nectaries; petioles 5–7 cm long, with pubescence like stem; stipules (Fig. 1f) lance-ovate, 1.5 cm long, 6–12 mm wide, minutely lepidote, sessile and amplexicaul, deciduous, leaving annular scars. Pedicels solitary in the leaf axils, 1–2 cm long (to 6 cm in fruit), stout (3–4 mm in diameter and swollen distally); involucellar bracts (Fig. 2r) 6, distinct or nearly so, cordate-ovate (and thus basally plicate), 18–20 mm long, ca. 15 mm wide, minutely lepidote; calyx (Fig. 2r) ca. 3.5 cm long, densely and minutely lepidote-pubescent, ca. half-divided, the lobes ca. 2 cm long, plicate distally in bud, lacking nectaries; petals 9–10 cm long, 3–3.5 cm wide, rose-pink or red, coarsely lepidote-pubescent externally; staminal column 7.5 cm long, more or less pubescent basally, filamentiferous distally, the filaments 2–4 mm long, styles emerging from staminal column, obscurely pubescent or subglabrous, the stigmas capitate, 1.5 mm in diameter. Capsules ovoid, 3–3.5 cm long, 2.5–3 cm in diameter, 5-locular (“10-celled”), densely yellowish lepidote, densely woolly internally; seeds numerous, [immature] reniform, 3–4 mm long, densely ferruginous-pubescent. Chromosome number unknown.

Phenology. Apparently flowering and fruiting throughout the year.

Distribution. New Guinea (see map in Borssum Waalkes, 1956: 42, fig. 1) and New Britain; in primary and secondary forest; 30–2400 m.

Illustrations. Borssum Waalkes (1956: figs. 9, 10, 11).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** WEST IRIAN: below Okdenan, 05°S, 141°E, 1400 m, *Reksodihardjo* 530 (L). **Papua New Guinea.** WESTERN: Nomad River Subprovince, 10 km above the junction of Strickland and Tomu Rivers, 06°30'S, 142°08'E, 80 m, *Gideon LAE-76153* (A, L).—WESTERN HIGHLANDS: Hagen Subdistrict, lower Kaugel Valley, 2200 m, *Robbins* 440 (A, L).—MADANG: Aiyura, 1800 m, *Smith NGF-1047* (L); Aiyura 1900 m, *Womersley* 4425 (A, K, L).—EAST SEPIK: near Langu village, 40–200 m, *Takeuchi & Wiakabu* 10043 (A-2).—EASTERN HIGHLANDS: Okapa area, 2000 m, *Brass* 31835 (L); Kassam, 1370 m, *Brass* 32385 (L, NY); just above Akuna, 06°22'S, 145°56'E, 1700 m, *Hartley* 11985 (A, K, L); Okapa Subdistrict, between Wanatabi and Purosa, 1550 m, *Hartley* 13680 (A, L); Kainantu Subdistrict, Wanatabi–Puros road, 1800 m, 06°35'S, 145°40'E, *Henty & Katik NGF-41991* (A, K, L); Kainantu Subdistrict, Kassam Pass, 06°10'S, 146°5'E, 1300 m, *Kikori NGF-32706* (L); Kainantu Subdistrict, 1 mi E of Odentenu, 1900 m, *Pullen* 727 (L); Kainantu Subdistrict, Arau–Andandara road, 1600 m, 06°28'S, 146°5'E, *Striemann NGF-23962* (L).—CENTRAL: Kairuku Subdistrict, 1 mi W of Maipa village, 55 m, *Darbyshire* 864 (A, L); Kairuku Subdistrict, between Maipa and Inaukina villages, 50 m, *Darbyshire* 959 (L); Maigo, 10°10'S, 148°10'E, 30 m, *Kairo NGF-17263* (K, L); Port Moresby Subdistrict, Kuriva Forestry Area near Veimura River, 65 m, 09°5'S, 147°5'E, *Streiman & Kairo LAE-51549* (L); Goilala Subdistrict, road from Woi tape to Kosipi, Uriko, 07°S, 147°E, 2000 m, *van Royen NGF-20194* (L); Subdistrict Rigo, near Oboha village, 56 m, 09°50'S, 148°5'E, *Wiakabu & Giyowosa LAE-70443* (L, US).—GULF: Kikori Subdistrict, Wabo dam site ridge 305° ridge face on Purari River, 250 m, 07°0'S, 145°10'E, *Conn et al. LAE-66290* (L).—SOUTHERN HIGHLANDS: near Waro airstrip 20 km SSW of Kutubu, 500–600 m, 06°31'S, 143°10'E, *Jacobs* 9235 (L); Kutubu patrol area, Ubogo, 490 m, *Takeuchi* 9114 (A).—WEST NEW BRITAIN: Kandrian Subdistrict, Pirilongi Village, 06°06'S, 150°45'E, 400 m, *Sayers NGF-21980* (L).

Talipariti archboldianum (Fig. 2r), *T. dalbertisii* (Fig. 2q), and *T. schlechteri* (Fig. 4) are the only pink- or red-flowered species with a calyx 3 cm long or more and petals 9–10 cm long. Only *T. elatum* with yellow corollas (Fig. 2a) has flowers of comparable size.

Collectors' notes state that the inner bark is used for making ropes (*Womersley* 3386), for making string (*Womersley* 4425), and that long strips of outer bark “are preferred material for flooring and sleep mats” (*Takeuchi & Wiakabu* 10043). The use of bark fibers for basketry is also reported (*Takeuchi* 9114).

2. *Talipariti aruense* (Hatusima ex Borssum Waalkes) Fryxell, comb. nov. *Hibiscus aruensis* Hatusima ex Borssum Waalkes, *Reinwardtia* 4(1): 44, fig. 2. 1956.—TYPE: MOLUCCAS. [INDONESIA. Maluku:] Aru Island, Pulau Wokam, Selibatabata, 40 m, 18 Jun 1938, *Buwalda* 5270 (holotype: BO; isotypes: A-2! BO, BRI, BZF, L, PNH, SING; photo of K isotype: TEX!).

Fig. 2p.

Trees 20–22 m tall, the twigs with minute stellate pubescence and simple hairs 0.5–0.7 mm long. Leaf blades ovate, 8–13 cm long, 6–10 cm wide, basally somewhat cordate, the margin entire, apically acute or acuminate, palmately 7–9-nerved (the nerves prominently raised beneath), very minutely stellate pubescent above and beneath (hairs 0.1 mm in diameter), with an elongate nectary 13–20 mm long near base of midrib beneath; petioles 3.5–6 cm long, minutely pubescent; stipules oblong-ovate, ca. 1 cm long, 6–7 mm wide, sessile and amplexicaul, acute, minutely puberulent, deciduous, leaving annular scars. Pedicels solitary in the leaf axils, 1–2 cm long, minutely pubescent; involucellar bracts (Fig. 2p) 8–10, distinct, cordate-lanceolate, 2 cm long, somewhat arcuate, minutely and densely (but obscurely) pubescent,

the bases auriculate (i.e., laterally reflexed), narrowed markedly to an acute (-acuminate) apex; calyx 16–20 mm long, subequal to or slightly exceeding involucler, yellowish puberulent, deeply divided, the calyx nectaries vestigial (?) or absent; petals 5–8 cm long, “violet,” externally stellate-lepidote-pubescent; staminal column 5–8 cm long, subequal to petals, basally stellate-pubescent, filamentiferous in distal half, the filaments 5–7 mm long; styles emergent from the staminal column, distally free, subglabrous, the stigmas obliquely capitate, 1.8 mm in diameter. Capsules narrowly ovoid, 3–4 cm long, 1.5 cm in diameter, hirsute with antrorse simple hairs 1.5–2 mm long and with minute stellate hairs interspersed, 10-locular [ex descr.]; seeds numerous, reniform, 2.5 mm long, densely stellate-pubescent, the hairs dark-ferruginous, 1–2 mm long. Chromosome number unknown.

Phenology. Collected in flower in March, June, and August; in fruit in July.

Distribution. Moluccas and New Guinea (see map in Borssum Waalkes, 1956: 42, fig. 1); in primary forest; 40–850 m.

Illustration. Borssum Waalkes (1956: 45, fig. 2).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** WEST IRIAN: Idenburg River, 4 km SW of Bernhard Camp, 850 m, *Brass & Versteegh 13126* (A, L); Hollandia, Bernhard bivak, 50 m, *Neth. Ind. For. Service bb. 25688* (L).

Talipariti aruense is notable for its involucler of 8–10 distinct bracts, which are reflexed laterally and sharply acute apically. The staminal column is subequal to the corolla and bears filaments 5–7 mm long. Among the pink- or red-flowered species, only *T. dalbertisii* and *T. ellipticifolium* have filaments as long, but they have only 6 involucellar bracts and much larger calyces.

3. *Talipariti borneense* (Airy Shaw) Fryxell, comb. nov. *Hibiscus borneensis* Airy Shaw, Hook. Icon. Pl. 34. t. 3377. 1939.—TYPE: BORNEO [MALAYSIA] Sarawak: Dulit Trail, under 300 m, 30 Aug 1932, *Native Collector 1541* (lectotype, here designated: K-sheet 1; isotypes: A! K-sheet 2! L! SING; photos of lectotype and K isotype: TEX!). Fig. 1h.

Trees 30 m tall, the trunks to 80 cm in diameter, buttressed, the twigs minutely yellowish puberulent becoming glabrescent. Leaf blades broadly ovate, 12–20 cm long, somewhat wider than long, basally cordate (the sinus open), the margin entire, apically acute, palmately 7-nerved, the nerves raised beneath, glabrous above, very minutely and sparsely pubescent to almost glabrous beneath, lacking foliar nectaries; petioles 10–15 (–20) cm long, with pubescence like stem; stipules broadly orbicular and undulate, ca. 1 cm long and wide, sessile and amplexicaul, more or less reflexed and contorted (Fig. 1h), roughly pubescent (hairs to 1 mm long), apically rounded to subacute, relatively persistent. Pedicels solitary in the leaf axils, 2–5 cm long, minutely puberulent, slender; involucellar bracts 8–10, distinct, narrowly ovate, 1–1.5 cm long, 4–7 mm wide, spreading (in bud) to reflexed, minutely puberulent, more or less laterally reflexed; calyx 1.5–2 cm long, minutely yellowish puberulent, costate, ca. half-divided or less, lacking nectaries; petals 4–8 cm long, 2–4 cm wide, reflexed at anthesis, white (with yellowish base) but drying darker (“greenish white tinged with pink”), externally pubescent, bearded on margins of claw; staminal column 3 cm long, essentially glabrous, filamentiferous along entire length, the filaments ca. 2 mm long; styles emerging from staminal column, distinct for ca. 1 mm, hirsute, the stigmas capitate, 2–3 mm in diameter.

Capsules globose to ovoid, 1.5 cm long, 2 cm in diameter, 5-locular, externally densely stellate-lepidote pubescent and with scattered simple hairs (the latter 1–1.5 mm long), internally densely wooly, the hairs pallid, 3–4 mm long; seeds ca. 7 per locule, reniform, 3–4 mm long, densely lanate, the hairs 3–4 mm long, ferruginous. Chromosome number unknown.

Phenology. Probably flowering and fruiting throughout the year.

Distribution. Borneo; in moist primary forests; 5–300 m.

Illustrations. Airy Shaw (Hook. Icon. Pl. 34: t. 3377. 1939).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** EAST KALIMANTAN: Loa Haur, W of Samarinda, 50 m, *Kostermans* 6758 (A, L-2); Loa Haur, W of Samarinda, 30 m, *Kostermans* 7010 (A, L), West Kutei, Belajan River near Tabang, 100 m, Aug 1957, *Kostermans* s.n. (L); Oost Koeti, Loa Doeri, 5 m, *Neth. Ind. For. Serv.* 24017 (A, L).

Talipariti borneense is the only species of *Talipariti* with manifestly reflexed petals.

4. *Talipariti bowersiae* Fryxell, sp. nov.—TYPE: PAPUA NEW GUINEA. Western Highlands: Hagen Subdistrict, Kurupili, Kepaka, Upper Kaugal, 7350 ft, 5 Feb 1969, *Bowers* 635 (holotype: US!; isotypes: CANB! US!). Fig. 3.

Arbores ramis nodosis, ramulis dense puberulis, pilis stellatis ferruginis; laminis foliorum ovatis discoloribus nectariis foliorum desititutis; stipulis lanceolato-ovatis sessilis amplexicaulibus; pedicellis axillaribus 1.5–2.5 cm longis dense pubescentibus; bracteis involucellorum 5–8 fere distinctis liguliformibus vel anguste ovatis; calyce 2.8–3.3 cm longo dimidio partito dense ferrugineo-pubescenti; capsulis 3–3.5 cm longis ovoidibus vel ellipsoidibus plus minusve pentangularibus dense pubescentibus.

Trees to 8 m tall, “gnarled and broken, trunk very irregular in shape,” the young stems densely puberulent, the hairs stellate, 0.2–0.4 mm long, ferruginous. Leaf blades ovate, 4–11 cm long, 2–9.5 cm wide, shallowly cordate, the margin entire, apically gradually acuminate, palmately 7-nerved, discolorous, the upper surface darker, minutely puberulent (the hairs scattered, stellate, less than 0.1 mm in diameter), the lower surface lighter and more or less ferruginous (the hairs denser, stellate, variable in size, the larger hairs up to 0.4 mm in diameter), lacking foliar nectaries; petioles 2–4.5 cm long, with pubescence like stem though often denser; stipules 1–2 cm long, 0.5–1 cm wide, lance-ovate, sessile and amplexicaul, densely and minutely pubescent externally, sparsely so internally. Pedicels solitary in the axils, 1.5–2.5 cm long, 2–3 mm in diameter, densely stellate-pubescent like petioles; involucl of 5–8 distinct or nearly distinct bracts, each ligulate to narrowly ovate, 2–2.5 cm long, 4–9 mm wide, minutely and obscurely lepidote (seemingly glabrous); calyx 2.8–3.3 cm long, ca. half-divided, densely ferruginous-puberulent (the hairs stellate, farinaceous), the lobes ecostate, nectary absent; petals 7–7.5 cm long, “pale yellow and peach,” externally densely stellate-pubescent; staminal column 5.5 cm long, stellate-pubescent, filamentiferous in distal half, the filaments 2–3 mm long [?], the anthers purplish; styles emergent from staminal column by 4–5 mm, the stigmas abruptly capitate, 2 mm in diameter. Capsules ovoid or ellipsoid, more or less pentangular, 3–3.5 cm long, 1.5 cm in diameter, 5-locular, with papery dissepiments, densely stellate-pubescent, the farinaceous hairs brownish to ferruginous, many-armed, variable in size, the largest 0.5 mm in diameter; seeds not seen.

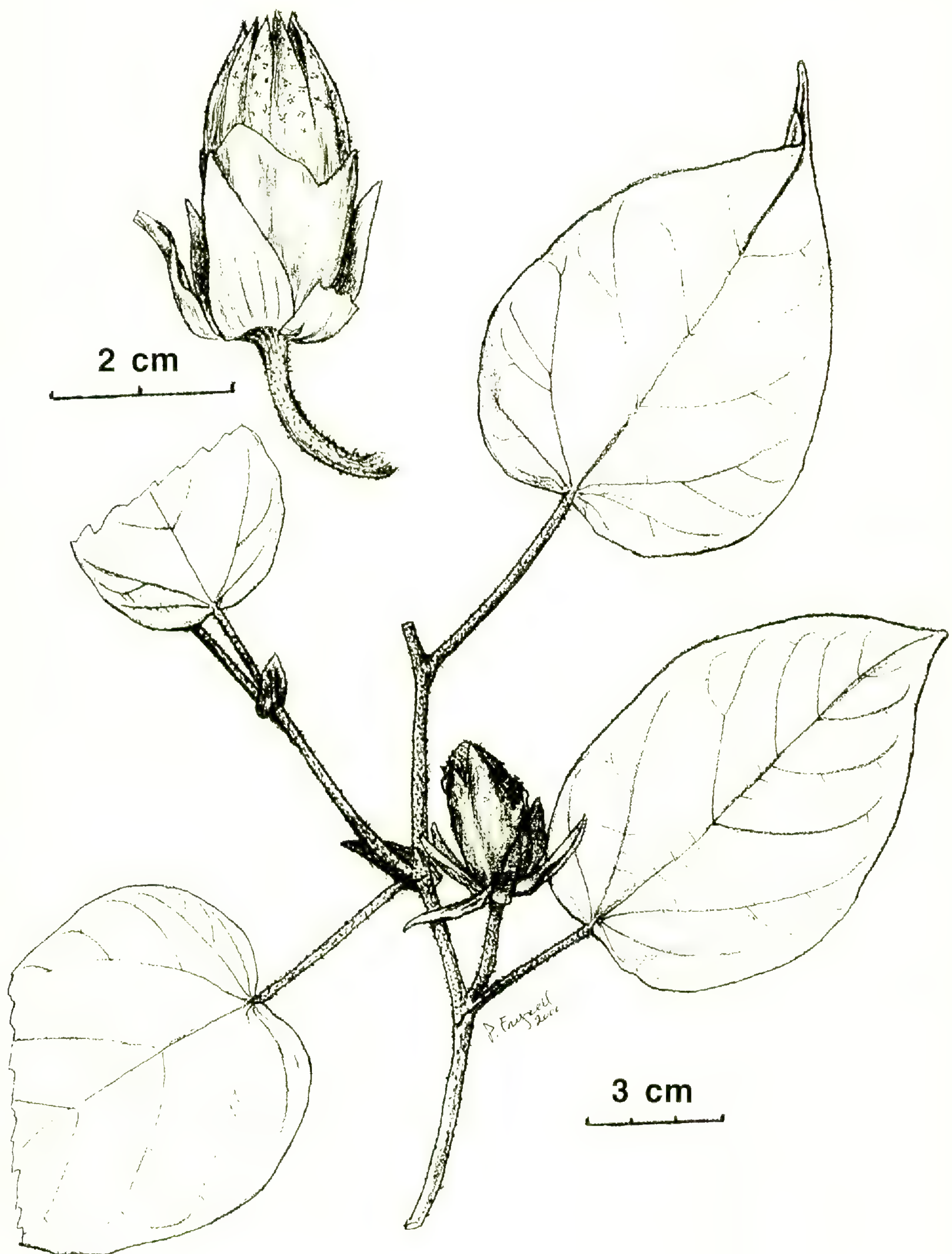


FIG. 3. *Talipariti bowersiae*. Flowering branch and separate fruit (Bowers 635)

Talipariti bowersiae is distinguished by its relatively narrow leaves and its dense, ferruginous puberulence on the stems, calyces, and fruits. It is known only from the type collection found "at streamside" in lower montane forest at ca. 2200 m elevation. The collector commented that "the bark yields fiber for pig rope."

The specific epithet is chosen to honor the collector of the type, Nancy Bowers (b. 1928), anthropologist from the University of Auckland.

- 5. *Talipariti celebicum*** (Koorders) Fryxell, comb. nov. *Hibiscus celebicus* Koorders, Med. Lands Plantent. 19: 359, 632. 1898. *Hibiscus tiliaceus* subsp. *celebicus* (Koorders) Borssum Waalkes, Blumea 14: 35. 1966.—TYPE: CELEBES. [INDONESIA. North Sulawesi:] Kajuwatu, *Koorders 17820* (lectotype: BO; isotypes: BO, L!). Fig. 2f.

Trees 20–30 m tall with erect trunk, the young stems tomentose, the hairs stellate, 0.5–1 mm long. Leaf blades rounded-ovate, 6.5–30 cm long, 4.5–30 cm wide, basally deeply cordate, the margin crenulate to subentire, apically acuminate, palmately 5–7-nerved, nearly glabrous above, sparsely stellate-tomentose beneath, foliar nectaries absent; petioles 1.2–22 cm long, stellate-tomentose; stipules oblong, 2–2.5 cm long, 1–1.5 cm wide, stellate-tomentose on both surfaces. Pedicels solitary in the leaf axils, 0.5–1.5 cm long, 2–5 mm in diameter, accrescent in fruit to 2 cm long, stellate-tomentose; involucl (Fig. 2f) gamophyllous, forming a cup half as long as the calyx, the ca. 8 elements triangular, 5–8 mm long, ca. 4 mm wide; calyx (Fig. 2f) 10–20 mm long, densely stellate-pubescent, deeply divided, each lobe with a prominent midrib, lacking nectaries on the midribs; petals 3–4 cm long, 2.5–3.5 cm wide, yellow with purplish base; staminal column ca. 2 cm long, the filaments and anthers ca. 1 mm (sessile in illustration cited below); styles and stigmas unknown. Capsules subrotund, 2 cm long, 1.5–2 cm in diameter, number of locules unknown, antrorsely hirsute, the hairs yellowish, ca. 1 mm long; seeds 3.5–4 mm long, densely wooly with long (ca. 2 mm) ferruginous hairs. Chromosome number unknown.

Phenology. Collected in flower in March.

Distribution. Sulawesi (Minahassa Peninsula).

Illustration. Koorders (1922, fig. 65).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** NORTH SULAWESI: Minahassa (Menado), 600 m, *Koorders 17816* (L), *Koorders 17819* (L), *Koorders 17823* (L).

Talipariti celebicum is distinguished by a combination of characters, as is indicated in the key to species

- 6. *Talipariti crestaense*** (Borssum Waalkes) Fryxell, comb. et stat. nov. *Hibiscus tiliaceus* subsp. *crestaensis* Borssum Waalkes, Blumea 14: 36. 1966.—TYPE: THE PHILIPPINES. LUZON: Isabela Province, Mt. Cresta, 3 Apr 1929, *Ramos 76992* (holotype: K!; isotypes: NY! SING). Fig. 2k.

Trees 6 m tall, the trunk 20 cm in diameter, the young stems very sparsely stellate-cinereous, the hairs ca. 0.2 mm in diameter, becoming glabrescent. Leaf blades broadly ovate to oblong-elliptic or somewhat obovate, 7–17 cm long, 3–9 cm wide, basally rounded or shallowly cordate, the margin entire to slightly undulate-crenate, apically acuminate, palmately 5-nerved, the midrib raised beneath, glabrate above, sparsely stellate-cinereous (especially on veins) to subglabrous beneath, foliar nectaries absent; petioles 2.5–7 cm long, stellate-cinereous like stem; stipules 8–17 mm long, 4–6 mm wide, lance-ovate (or slightly asymmetrical), stellate-cinereous, deciduous, leaving prominent annular scars. Pedicels solitary in the leaf axils, 0.5–1 cm long, 2–2.5 mm in diameter, stellate-cinereous; involucl (Fig. 2k) more or less gamophyllous, half the length of the calyx or more, ca. 15 mm long, 10-parted, the segments 9–11 mm long, 2–4 mm wide, lanceolate, acute;

calyx 2–2.5 cm long, minutely puberulent, with a vestigial nectary on the midrib of each lobe; petals 5–7 cm long, yellow (possibly with a dark spot at base?), externally densely pubescent (except basally) with minute arachnoid hairs, the margins of the claws bearded; staminal column 22–25 mm long, apically 5-dentate, glabrous, the filaments 2–3 mm long arising along length of column, the anthers 1–1.5 mm long. Capsules subglobose, 1.5 cm long and in diameter, 5-locular, densely antrorsely pubescent, the hairs yellowish; seeds [immature] reniform, ca. 4 mm long, pubescent. Chromosome number unknown.

Phenology. Collected in flower in April.

Distribution. The Philippines (Luzon); in forest at low elevation; possibly Thailand (see specimen citation below).

Illustration. Borssum Waalkes (1966: 37, fig. 6b).

ADDITIONAL SPECIMENS EXAMINED. **Thailand.** Sitan, Loie, 300 m, *Dec 24* [3630] (US). This specimen is only tentatively included here.

Among the yellow-flowered species with cupuliform involucels, *T. crestaense* is distinguished by having leaves that are often oblong-elliptic and only shallowly (if at all) cordate and lacking a foliar nectary. The involucel (Fig. 2k) is in some respects intermediate between the cupuliform type and the type with distinct elements. Although the original description says a foliar nectary is present near the base of the midrib, a careful examination of the type specimens (K, NY) did not confirm its presence.

7. *Talipariti dalbertisii* (F. Mueller) Fryxell, comb. nov. *Hibiscus dalbertisii* F. Mueller, Descr. Notes Papuan Pl. 4: 56. 1876.—TYPE: NEW GUINEA. Fly River, *d'Albertis s.n.* (holotype: not located; isotypes, fide Borssum Waalkes, 1966: BM, FI, MEL).

Hibiscus cardiostegius Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 20: 153. 1917.—TYPE: NEW GUINEA. [INDONESIA. West Irian:] Humboldt Bay, north coast, ca. 75 m, 2 Jan 1911, *Gjellerup 417* (holotype: not located; isotypes: BO, K, L!).

Hibiscus fluminis-idenburgii Borssum Waalkes, Reinwardtia 4(1): 53. f. 6. 1956.—TYPE: NEW GUINEA. [INDONESIA. West Irian:] Idenburg River, 1200 m, Feb 1939, *Brass 12978* (holotype: BO; isotypes: BM, GH!, L!).

Figs. 1d, 2q.

Trees (3–) 10–37 m tall, the twigs densely stellate-pubescent, the hairs mostly 1 mm long, yellowish. Leaf blades ovate, 5–17 cm long, 3–13.5 cm wide, smaller distally, basally cordate, the margin entire, apically acute, palmately 7-nerved, discoloured, the upper surface sparsely and minutely pubescent (especially on nerves), the lower surface sparsely to densely stellate-pubescent, the hairs 0.2 mm in diameter, foliar nectaries absent; petioles 3–6 cm long with pubescence like stem; stipules (Fig. 1d) 1–1.5 cm long, 1 cm wide, ovate-acute, sessile and amplexicaul, stellate-pubescent externally, minutely so internally, deciduous, leaving annular scars. Pedicels solitary in the leaf axils, 0.5–3 cm long, stout (2–3 mm in diameter), stellate-pubescent; involucellar bracts (Fig. 2q) 6, distinct, ovate-cordate (thus basally plicate), 15–30 mm long, 10–22 mm wide, stellate-pubescent; calyx (Fig. 2q) 3–4 cm long, densely and softly yellowish pubescent and with a few scattered, large stellate spicules, ca. half-divided, the lobes 2–2.5 cm long, the

margins plicate in bud, the midribs of the lobes with prominent nectaries (often concealed by the involucrel); petals 9–10 cm long, 2–3 cm wide, deep pink, externally pubescent, the hairs semi-lepidote, pubescence denser toward the base; staminal column nearly equaling the petals, more or less stellate-pubescent basally, filamentiferous distally, the filaments 4–8 mm long; styles emerging from the staminal column by ca. 5 mm, the stigmas capitate, asymmetrical, 2 mm in diameter. Capsules ovoid, ca. 4 cm long, 1.5–2 cm in diameter, 5-locular (“10-celled”), antrorsely strigose, the hairs ca. 3 mm long, yellowish; seeds numerous, reniform, 3–4 mm long, densely ferruginous-wooly. Chromosome number unknown.

Phenology. Flowering and fruiting more or less throughout the year.

Distribution. New Guinea, “the area between Mamberamo R., Idenburg R., North coast and the frontier between West and East New Guinea, also the area of the Digul R., Madang, Sepik, and the Fly R.” (Borssum Waalkes 1966: 41); in primary and secondary forest, often along river banks; near sea level to 1750 m; sometimes planted near villages.

Illustrations. Borssum Waalkes (1956: fig. 6; 1966: 40, fig. 7b).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** WEST IRIAN: Hollandia and vicinity, 40 m, *Brass* 8912 (A, L); Idenburg River, 15 km SW of Bernhard Camp, 1750 m, *Brass & Versteegh* 11959 (K, L); 6 km SW of Bernhard Camp, 1100 m, *Brass & Versteegh* 12525 (A, K as photo, L); District Hollandia, Bodem River, 60 km SE of Sarmi, 75 m, *Iwanggin* 5895 (L); District Hollandia, near Kwansem bivouac, St. from Sidoarsi Mts., ca. 200 km W of Hollandia, *Iwanggin* 9024 (A, L); slope of Cyclops Mtns, Sukarnapura, 100 m, *Kostermans & Reksodihardjo* 69 (L); 05°38'33"S, 141°E, *Reksodihardjo* 526 (L-3); Okwalimkam River headwater, 1250 m, 05°2'S, 140°55'E, *Ridsdale & Galore* NGF-33153 (A, L); weg naar Hollandia-Binnen, 50 m, *Schrijn* 3594 (L-2); W of Hollandia, N of Simboro Strait of Sentani Lake, *Sigafoos* 12 (A); SW of Hollandia, Lake Plain of Sentani Lake and foothills of Cyclops Mtn, *Sigafoos* 115 (US); District Hollandia, road leading to Hamadi, 70 m, *van Royen* 4104 (A, L); Cycloop Mtns, along path to Ormoe, 380 m, *van Royen & Sleumer* 5639 (L); District Hollandia, Cycloop Mtns, road to Sentani, 320 m, *van Royen & Sleumer* 5655 (A, L-2); Cycloop Mtns, gulley leading to Kota Nica, *van Royen & Sleumer* 5857 (A); District Hollandia, Cycloop Mtns, path Dozai-Dafonsero, N of Dozai, 1100 m, *van Royen & Sleumer* 6426 (A, L); along river Digoel, near Wage Div., 5 m, *Versteegh* 4856 (L). **Papua New Guinea.** CENTRAL: Subdist. Rigo, near Oboha village, *Wiakabu & Giyowosa* 70443 (A, US).—EAST HIGHLANDS: Kainantu Subdistrict, top of Kassam Pass, 1700 m, 06°13'S, 146°4'E, *Streimann* NGF-47903 (L).—MADANG: Gogola Valley road, 30 mi from Madang, 60 m, 05°15'S, 145°35'E, *Womersley & Vink* NGF-12578 (L).—WESTERN: Kiunga Subdistrict, Ingembit, 05°38'S, 141°0'E, *Ridsdale et al.* NGF-31960 (A, K, L).—WEST SEPIK: Subdistrict Telefomin, near Busilmin airstrip on track to Telefomin Basin, 1500 m, 04°55'S, 141°8'E, *Barker* LAE-66835 (L); Leitre village, 10 m, 02°50'S, 141°35'E, *Sayers* NGF-18951 (L); Amanab Subdistrict, Imonda Patrol Post, 300 m, 03°20'S, 141°10'E, *Streimann & Martin* LAE-52870 (A, L); Telefomin Subdistrict, Bielga River below junction with Mogofogola River on Busilmin-Folongonom track, 1800 m, 05°00'S, 141°05'E, *Vinas* LAE-59573 (L).

Talipariti dalbertisii (Fig. 2q), *T. archboldianum* (Fig. 2r), and *T. schlechteri* (Fig. 4) are the only pink- or red-flowered species with a calyx 3 cm long or more and petals 9–10 cm long. Only *T. elatum* (with a yellow corolla) has flowers of comparable size (Fig. 2a).

“A highly decorative tree which might be introduced in horticulture” is noted on the collection label of *van Royen* 4104.

- 8. *Talipariti elatum*** (Swartz) Fryxell, comb. nov. *Hibiscus elatus* Swartz, Fl. Ind. Occid. 2: 1218. 1800. *Paritium elatum* (Swartz) G. Don, Gen. hist. 1: 485. 1831. *Hibiscus tiliaceus* var. *elatus* (Swartz) Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 4: 63. 1900. *Hibiscus tiliaceus* subsp. *elatus* (Swartz) Borssum Waalkes, Blumea 14: 30. 1966.—TYPE: JAMAICA. *Swartz s.n.* (holotype: S!).

Hibiscus azanzae DC., Prodr. 1: 454. 1824. *Paritium azanzae* (DC.) G. Don, Gen. hist. 1: 485. 1831.—TYPE: Icones Florae Mexicanae s.n.! (Torner Collection Accession no. 6331.1423, Hunt Institute). Cf. copy at G, photo F-30498.

Paritium elatum var. *macrocarpum* Grisebach, Fl. Brit. W. Ind. Islds. 87. 1859.—TYPE: JAMAICA. 1858, *March* 99 (lectotype, here designated: GOET!).

Pariti grande Britton in Small, Man. SE Fl. 859. 1933.—TYPE: U.S.A. Florida: Fort Myers, Edison Reservation, near dock, 2 Jul 1930, *Buswell* s.n. (lectotype, here designated: NY!).

Figs. 1c, 2a, b.

Trees 6–25 m tall, the trunks straight, up to 35 cm in diameter, the young stems minutely but obscurely puberulent. Leaf blades broadly ovate, 8.5–23 cm long, 6–30 cm wide, smaller and narrower distally, basally deeply to shallowly cordate (the sinus sometimes closed) or rounded in upper leaves, the margin entire or obscurely crenulate, apically short-acuminate, palmately or pedately 7 (–11)-nerved (the nerves raised beneath), discolourous, glabrous above, minutely puberulent beneath (hairs 0.1–0.2 mm long), with one or more obscure to prominent nectaries (3–5 mm long) at base of principal veins beneath; petioles 6–13 cm long, minutely puberulent; stipules (Fig. 1c) 3 cm long, 1.2–1.5 cm wide, oblong, acute, pubescent, sessile and amplexicaul, deciduous, leaving a prominent annular scar. Pedicels solitary in the upper axils, 1–3 cm long, stout (4–10 mm in diameter), minutely puberulent; involucre (Fig. 2a) cupuliform with 8–10 pointed teeth 4–5 mm long, the whole involucre 14–20 mm long, ca. half length of calyx, with acute or rounded sinuses, the teeth puberulent, the base glabrate, deciduous circumscissily (with the calyx) in fruit (Fig. 2b); calyx (Fig. 2a) (2.5–) 3–5 cm long, ca. half-divided, the lobes lanceolate, 2 cm long, 1 cm wide, densely yellowish puberulent, with an obscure nectary on the midrib of each lobe, deciduous circumscissily in fruit (Fig. 2b); petals 7–12 cm long, 1.5–4 cm wide, yellowish with red center, fading red-orange, externally with minute arachnoid hairs, internally glabrous, narrowly elliptic; staminal column (5–) 7–8 cm long, glabrous, pallid, filamentiferous in the distal 2/3, the filaments 2–5 mm long, the anthers and pollen yellow; styles emergent from the staminal column, sometimes exceeding the petals, pubescent, the stigmas purplish, obliquely capitate, 1.5–2 mm in diameter. Capsules ovoid, sometimes 5-angled, 2.5–4 cm long, 2.5 cm in diameter, 5-loculate (“10-celled”), densely hirsute, the hairs yellowish, appressed, 2–3 mm long; seeds numerous, 5 mm long, reniform, densely short-pubescent, the hairs 0.5 mm long or less. Chromosome number: $2n = 90$ (Butorina et al. 1990).

Phenology. Flowering and fruiting throughout the year.

Distribution. Jamaica and Cuba, but introduced in other parts of the Caribbean (Kimber 1970; Little et al. 1974), Florida, Hawaii, and elsewhere (e.g., Little et al. 1974: 518; Marais & Friedmann 1987: 25).

Illustrations. Adams (1971: 15); Bates (1965: 72, fig. 2D); Kimber (1970: figs. 3–5); Little et al. (1974: 519, fig. 496); Meninger (1962: pl. 204*, as *H. elatus*); Small (1933: 859, as *P. grande*).

ADDITIONAL SPECIMENS EXAMINED. U.S.A. FLORIDA: Dade Co., Bent Tree community, SW side of Miami, ornamental tree, *Nee* 35058 (NY, TEX).—HAWAII: Oahu, Makiki Valley [cult.], *Degener* 18217 (A, NY); Hawaii, from ridge between Waipi'o and Waimanu Valley, 23 Feb 1986, *Gon* s.n. (A, BISH, US); Kauai, Kapaa [introduced], *Little* 31184 (US); HSPA Forest Nursery, Manoa Valley, *Yuncker* 3567 (NY).

Cuba. CAMAGÜEY: vicinity of La Gloria, *Shafer 14* (NY-2).—CIENFUEGOS: Cieneguita, *Combs 672* (GH, NY, US); Soledad, *Gonzales 66* (A, NY), *Hodge & Howard 4009* (GH), *Jack 4072* (A), *Jack 4771* (A), *Jack 4705* (A), *Salvoza 538* (A), *Wright 2074* (GH).—ISLA DE LA JUVENTUD. Isle of Pines, Santa Fé, *Britton et al. 15115* (NY).—LA HABANA: San Antonio de los Barrios, *Baker 4680* (NY); Havana Botanic Garden, *Jack 4010* (A), May 1990, *Hernández s.n.* (NY); near Rincón, *Van Hermann 536* (MO, NY).—MATANZAS: 1 km E of Playa Larga, *Acevedo-Rodríguez et al. 6306* (NY); vic. of Matanzas, Valley of the Canimar, *Britton et al. 477* (NY).—ORIENTE: 20 km W of Compania de Moa mill, Sierra de Moa, *Howard 5972* (GH).—PINAR DEL RÍO: Sierra Rosario, 22°50'N, 83°0'W, 370–390 m, *Gentry et al. 71346* (MO).—SANTA CLARA: Trinidad Mountains, *Britton & Britton 5081* (NY); near San Blas, *Jack 7338* (NY), *Rehder 1162* (A); Lomas de Banao, *Bro. León 234* (NY).—SANTIAGO DE CUBA: vicinity of Baracoa, *Pollard et al. 73* (GH, NY). **Puerto Rico.** Caribbean National Forest, 18°00'N, 65°45'W, *Boom 7046* (NY, TEX); Caribbean National Forest, 18°17'N, 65°47'W, *Boom & Rivera 6806* (NY); Utuado, Bosque Ins. Río Abajo, *Little 14839* (GH, NY); Fajardo, planted on street, *Liogier et al. 32306* (NY); Río Piedras, street tree, *Liogier 35690* (BRIT, NY). Mpio. Cayey, just W of intersection of rtes. 184 and 179, 18°07'N, 66°03'W, *Miller & Taylor 6007* (MO); Mpio. Luquillo, El Verde Field Station, rte. 186 at the Río Sonadora, 18°20'N, 65°50'W, 350 m, *Taylor et al. 10898* (MO). **Haiti.** NORD-EST: Massif du Nord, sobre Morne Bois Pin, 19°34'N, 72°14'W, *Zanoni & Mejía 35808* (NY, TEX). **Dominican Republic.** PUERTO PLATA: 3.8 km al E de Imbert, 19°45'N, 70°47.5'W, *Zanoni & Pimentel 29220* (TEX).—SAN CRISTÓBAL: San Cristóbal en la calle [cult.], *Liogier & Liogier 20271* (NY).—SANTO DOMINGO: Trujillo University [cult.], *Jiménez 2772* (NY-2). **Jamaica.** CORNWALL: St. James Parish: near Flagstaff, *Lundell 16975* (LL, TEX). Trelawney Parish: Cockpit Country, Troy, *Britton 627* (NY); E side of Troy, *Gillis 8982* (A).—SURREY: Kingston Parish: Kingston, Mona Reservoir, in park, *Andrews 747* (NY); Phoenix Park, Moneague, *Fawcett & Harris 7046* (MO, NY); Kingston, *March 95* (GH), 8 Mar 1885, *Sargent s.n.* (A); Kingston, Hope Gardens, *Wetmore & Abbe 757* (A). Portland Parish: Blue Mountains, *Morley & Whitefoord 926* (A), *Judd 5493* (NY). St. Andrew Parish: near Richards reservoir, *Yuncker 17745* (NY). **Dominica.** St. Paul Parish, between Pont Casse and Pagua Valley, Central Forest Reserve (said to be planted by Forest Dept.), *Hill 22081* (TEX); St. Joseph Parish, D'Leau Gommier [cult.], *Nicolson 2015* (GH, NY, US); St. Paul Parish, Riversdale (below Cassé), *Nicolson 4060* (NY, US). **Martinique.** Introduit de l'île d'Haiti, *Duss 2023* (NY). **St. Lucia.** Barra d'Isle, *Cooley 8740* (GH), *Sturrock 411* (A); Edmund Forest, from plantation, *Slane 331* (A-2). **Guadeloupe.** Boivin, Abymes, *Stehlé 2036* (A). **Trinidad.** Port of Spain, Victoria Square, *Broadway 7* (A), *Broadway 6537* (MO).

Colombia. BOLÍVAR: Mpio. Cartagena, San Bernardo, Isla de Tintipán, 09°45'N, 76°04'W, Mar Caribe, *Callejas & Bornstein 11026* (LL). **Argentina.** CORRIENTES: Facultad de Agronomía y Veterinaria [cult.], *Krapovickas & Cristóbal 11351* (GH, LL, TEX, US).

Talipariti elatum is distinguished from other species of *Talipariti* in having a deciduous calyx and involucre, which falls with the corolla following anthesis, as is depicted in Fig. 2b. It also has larger flowers (calyx 3–5 cm long; petals 7–12 cm long, 2–4 cm wide) than most of the other species and is the only yellow-flowered species to have a calyx 3 cm long or more (Fig. 2a).

Kimber (1970) describes the economic uses of this species as a timber tree and its “incipient domestication.” It is sometimes planted in monoculture (Dominica: *Nicolson 2015*; St. Lucia: *Slane 311*) for timber harvesting.

Adams (1971, pp. 17 ff.) describes a case of introgression of Seaside Mahoe (*T. tiliaceum* var. *tiliaceum*) and Blue Mahoe (*T. elatum*) in St. Ann Parish, Jamaica, at an elevation intermediate between those of the two parental species, and the same phenomenon was noted by Kimber (1970). Such hybridization and/or introgression can occur where these species come into contact, but it seems to have little or no effect on the overall integrity of the two species, although it can pose problems in the identification of individual specimens from such hybrid-derived populations.

A lectotype is here chosen for the name *Pariti grande* Britton. A series of specimens, mostly collected by W. M. Buswell in 1930 in Fort Myers, exists in the NY herbarium together with several letters from Buswell to Small and some drawings by Buswell. These represent two or perhaps three species (or two species

and a hybrid) that were evidently the basis for the treatment of *Pariti* in Small's Flora. Four of these sheets clearly represent the basis for the name *P. grande*, although none of them is so annotated. One of them is here designated as lectotype and has been so labeled.

9. *Talipariti ellipticifolium* (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus ellipticifolius* Borssum Waalkes, Reinwardtia 4(1): 55, fig. 7. 1956.—TYPE: PAPUA NEW GUINEA. East Sepik: Karosomeri River, Womersley NGF-3689 (holotype: LAE; isotypes: A!, BM, BO, BRI, K as photo TEX!, L!, SING).

Fig. 2o.

Trees "slender and straight" 8–20 m tall, the twigs sparsely and minutely stellate-pubescent (the hairs ca. 0.5 mm long), glabrescent. Leaf blades broadly elliptic to ovate, 9–21 cm long, 5–15 cm wide, basally rounded to subtruncate (rarely somewhat cordate), the margin entire, apically short-acuminate, palmately 5–7-nerved, sparsely stellate-puberulent (especially on nerves) to glabrescent above, more densely puberulent beneath, the midrib abaxially with a nectary 5–11 mm long positioned ca. 1 cm above the leaf base; petioles 2.5–10.5 cm long, with pubescence like stem; stipules 7–12 mm long, 4–6 mm wide, ovate, acute, sessile and amplexicaul, minutely stellate-pubescent, deciduous. Pedicels solitary in the leaf axils, 1–2 cm long; involucellar bracts (Fig. 2o) 6, distinct, lanceolate, 10–12 mm long, 3–5 mm wide, narrowed at base, spreading or reflexed, minutely pubescent or glabrous; calyx (Fig. 2o) 2–3 cm long, externally scabrid with stiff stellate hairs 0.5–1 mm long (especially toward the base), internally with minute stellate hairs, ca. half-divided, the lobes triangular or ovate, 8–15 mm long, 5-nerved, with a prominent nectary on each midrib positioned relatively near the base; petals 7–8 cm long, 2–3.5 cm wide, bright pink or red, externally pubescent, the hairs semi-lepidote; staminal column 4–7 cm long, basally pubescent, distally filamentiferous, the filaments 4–8 mm long, anthers purple; styles emergent from the staminal column, glabrous, the stigmas capitate, greenish, 2 mm in diameter. Capsules ovoid, ca. 2 cm long, 1.5 cm in diameter, 5-loculate ("10-celled"), acute to acuminate, antrorsely hirsute, the hairs 2–3 mm long; seeds unknown. Chromosome number unknown.

Phenology. Collected in flower from May thorough August.

Distribution. Papua New Guinea (see map in Borssum Waalkes 1956: 42, fig. 1); in secondary forest; 10–100 m.

Illustration. Borssum Waalkes (1956: 56, fig. 7).

ADDITIONAL SPECIMENS EXAMINED. **Papua New Guinea.** EAST SEPIK: near Ambunti, 10 m, *Hoogland & Craven 10182* (US, L-2); Ambunti Subdistrict, near Wagu, 60 m, *Hoogland & Craven 10372* (K, L-2); Ambunti Subdistrict, along Yapa (Hunstein River), 120 m, *Hoogland & Craven 10613* (L-2); Angoram Subdistrict, Amboin, ca. 100 m, 04°40'S, 143°35'E, *Millar & Dockrill NGF-35169* (L); Angoram Subdistrict, Amboin, 50 m, 04°5'S, 144°5'E, *Millar NGF-37543* (L).—MADANG: N of Aiome station, 120 m, 05°07'S, 144°45'E, *Henty NGF-27448* (L); near Mawan village, Gogol Valley, 60 m, *Hoogland 4880* (K, L-2); road to Utu, 60 m, 05°15'S, 145°40'E, *Millar NGF-22653* (L); Madang Subdistrict, Gogol Forestry Station, 30 m, 05°10'S, 145°25'E, *Stevens & Stone LAE-54694* (K, L).

Talipariti ellipticifolium stands out for having a reflexed involucl of six distinct, lanceolate bracts, which reveals a calyx with five prominent nectaries (Fig. 2o). This species is noted by *Hoogland & Craven 10372* as a source of timber "used in house building." Takeuchi (2000) states that the bark "is used as wall panels in houses" (p. 57) and "is peeled in strips as a sleeping mat" (p. 59).

10. *Talipariti glabrum* (Matsumura) Fryxell, comb. nov. *Hibiscus glaber* Matsumura ex Nakai, Bot. Mag. Tokyo 28: 310. 1914. *Pariti glabrum* (Matsumura) Nakai, Fl. Sylvat. Koreana 21: 99. 1936.—TYPE: JAPAN. [Bonin Islands] “Ogasawarajima,” *Matsumura s.n.* (holotype: TI).

Hibiscus glaber var. *cordatus* Nakai, Bot. Mag. Tokyo 28: 310. 1914.—TYPE: JAPAN. Bonin Islands: in insula Chichisima, Asahiyama, 13 Aug 1905, *Hattori s.n.* (holotype: TI).

Hibiscus boninensis Nakai, Bot. Mag. Tokyo 28: 311. 1914. *Pariti boninense* (Nakai) Nakai, Fl. Sylvat. Koreana 21: 98. 1936.—TYPE: JAPAN. Bonin Islands: in insula Mukôshima, 5 Aug 1905, *Hattori s.n.* (holotype: TI; isotype: TI).

Figs. 1j, 2h.

Trees 4–7 m tall, the stems glabrous or nearly so. Leaf blades leathery, broadly ovate, 3–10 cm long, 2.5–10 cm wide, the distal leaves smaller and narrower (sometimes oblong), basally rounded or shallowly cordate, the margin entire, apically acute or short-acuminate, glabrous, palmately 3–5 (–7)-nerved (the nerves raised beneath), with a small (1.5–3 mm) but prominent nectary at base of midrib beneath; petioles 1–3 (–7) cm long, glabrous or with a few weak stellate hairs <1 mm long; stipules (Fig. 1j) 15–25 mm long, 5–7 mm wide, oblong, sessile and amplexicaul, entire, apically rounded, essentially glabrous but with a white margin made up of a dense line of minute whitish arachnoid hairs, deciduous, leaving arched annular scars surrounding each node. Pedicels solitary, axillary or subterminal, 1–2 cm long in flower, 5–7.5 cm long in fruit, distally stout (2 mm in diameter), glabrous; involucler (Fig. 2h) cupuliform, 8–10-toothed, obscurely but densely pubescent, the stellate hairs minute (< 0.1 mm long), the teeth 2–3 mm long, sinuses rounded, internally densely yellowish pubescent; calyx (Fig. 2h) 20–22 mm long, greatly exceeding involucler, deeply 5-parted, the lobes 1.5 cm long, 6 mm wide, lanceolate, weakly ribbed, densely and minutely pubescent (obscurely so externally, prominently so internally), the calyx nectaries present and obscure or vestigial; petals 3–3.5 cm long, ca. 2 cm wide, yellow (fading red) with maroon center, externally pubescent, internally glabrous, the margins of the claw densely pubescent; staminal column 1.2–1.3 cm long, pallid, glabrous, filamentiferous throughout, the filaments ca. 1 mm long, the anthers yellow; styles emerging from the androecium (but 1 cm shorter than the corolla), the stigmas clavate, densely villous, dark purple. Capsules ovoid, shorter than to slightly exceeding the calyx, 12–15 mm long and in diameter, 5-locular, apically acute or obtuse (rarely slightly retuse), densely villous, the hairs ca. 0.5 mm long, yellowish, appressed; seeds numerous, 4–5 mm long, densely pubescent, the hairs 0.5–1 mm long. Chromosome number unknown.

Phenology. Apparently flowering and fruiting throughout the year.

Distribution. Bonin Islands: Muko Jima, Chichi Jima, and Haha Jima (Hahasima); 0–600 m (“abundant sea level to Mt. tops” *Wilson* 8264). One specimen is known from Yap Island, of the Caroline Islands Group.

ADDITIONAL SPECIMENS EXAMINED. **Japan.** BONIN ISLANDS: mountain back of Omura, *Fosberg* 31468 (NY, US), 31475 (CTES, OSH, TEX), 31479 (OSH, TEX), 31481 (OSH, TEX); bay shore N of Omura, *Fosberg* 31494 (US); old radio station E of Yankeetown, *Fosberg* 31505 (OSH, TEX); Isl. Chichijima, Seto-miharashidai, *Kanai & Ono* 764275 (K, L, NY); Mikazukiyama, *Murata et al.* 9 (A); between Kiyose and Tsurihama, *Murata et al.* 60 (A); Sakiura, *Murata et al.* 66 (A); Mikazukiyama-Okumura, *Sohma et al.* 715020 (MO); Mt. Mikazuki, Ogasawara-mura, *Fujita & Shimizu* 13 (BISH), 14 (L), 309 (A); Mt. Hoa, *Wilson* 8239 (A, US); Chichijima, 3 May 1917, *Wilson s.n.* (A); Ogasawara Islands, Chichijima, above Tsurihama beach, *Woolliams & Tannowa* 43 (PTBG); without precise

locality, 1853–1856, *Wright s.n.* (US); Shima-itibi, 28 Sep 1909, *s. coll. s.n.* (US). **Caroline Islands.** YAP ISLAND: Kanif, *Takamatsu 1935* (US).

U.S.A. HAWAII. Kauai, Lawai Valley, Pacific Tropical Botanical Garden [cult.], *Flynn 397* (PTBG), *Flynn 6327* (BISH, PTBG, TEX); Oahu, Waimea Arboretum [cult., ex Chichijima], *Simon 75P800* (BISH).

Talipariti glabrum is distinguished by its nearly glabrous foliage, its elongate (accrescent) fruiting pedicels, and by its distinctively white-margined stipules. It is closely allied to *T. hamabo*, both morphologically and geographically, although it does not achieve as northerly (temperate) a distribution as does the latter species.

According to Nakai (1936), *Hibiscus glaber* var. *cordatus*, also from Chichi Jima, differs in the cordate base of the leaf lamina. According to field notes (*Wilson s.n.*) the wood “is used by the Bonin Islanders for making the arms of canoes with which the outrigger is attached to the hull.”

The Yap Island specimen cited above conforms to *T. glabrum*, except that the stipules are not white-margined.

The collection listed as “*Hibiscus tiliaceus* var. β ?” by Hooker & Arnott (Bot. Beechey’s Voy. 259. 1838.) is *T. glabrum*.

- 11. *Talipariti hamabo*** (Siebold & Zuccarini) Fryxell, comb. nov. *Hibiscus hamabo* Siebold & Zuccarini, Fl. Jap. 1: 176. 1841. *Hibiscus tiliaceus* var. *hamabo* (Siebold & Zuccarini) Maximowicz, Diagn. Pl. Nov. Asiat. no. 6, in Mélanges 12: 427. 1886. *Pariti hamabo* (Siebold & Zuccarini) Nakai, Fl. Sylvat. Koreana 21: 99. 1936.—TYPE: JAPAN. “ad littora Wagaraki,” *hb. von Siebold s.n.* (lectotype, here designated: “exemplar quod florae japonicae componendae inseririt,” L-908.135-840!; isolectotypes: K-herb. Hooker!, “exemplar authenticum hb. Siebold,” L-908.135-827!). Figs. 1i, 2g.

Trees or shrubs to 5 m tall, the young stems softly stellate-pubescent, the hairs 0.5 mm or less. Leaf blades broadly obovate, 5–7 cm long, 6–8 cm wide, basally cordate, the margin subentire or irregularly crenate or undulate, broadest above the middle, apically abruptly and shortly acuminate, pedately 5–7-nerved, discolorous, densely whitish puberulent beneath, the upper surface sparsely and minutely stellate-pubescent (the hairs 0.1–0.2 mm in diameter), with an elongate nectary (Fig. 1i) 2–4 mm long at base of midrib beneath (sometimes obscure or even absent); petioles 1–2.5 cm long, with pubescence like stem; stipules (Fig. 1i) oblong-ovate, 12–15 mm long, 6–8 mm wide, sessile and amplexicaul, softly stellate-pubescent externally, deciduous, leaving annular scars. Pedicels axillary and solitary or aggregated on short side branches in few-flowered inflorescences, 3–12 mm long, becoming stout (3–5 mm in diameter) in fruit; involucler (Fig. 2g) cupuliform, 8–10 mm long, minutely puberulent, 8–10-toothed, the teeth narrowly triangular, 4–5 mm long; calyx (Fig. 2g) ca. 2 cm long, more densely pubescent than involucler, half (or more) divided, the lobes 10–13 mm long, with a strong midrib, the nectary on the midrib obscure; petals 4–5 cm long, 3–5 cm wide, bright yellow with a dark red center, externally pubescent; staminal column 1.5–2 cm long, about half the length of petals or less, glabrous, filamentiferous in the distal 2/3, the filaments 1–1.5 mm long, the anthers yellow; styles emergent from the staminal column, purplish, the stigmas capitate, ca. 1 mm in diameter. Capsules ovoid, 2.5–3 cm long, 1.5–2 cm in diameter, 5-locular, acute to somewhat beaked, densely yellowish hirsute, the hairs antrorse, ca. 1 mm long; seeds reniform, 4.5 mm long, minutely papillate (seemingly glabrous). Chromosome number unknown.

Phenology. Collected in flower and fruit from July through November.

Distribution. Southern Japan and Korea; near seashores (Ohwi 1965), sometimes cultivated elsewhere.

Illustrations. Bates (1965: 72, fig. 2C), Siebold & Zuccarini (1841, loc. cit., pl. 93*).

ADDITIONAL SPECIMENS EXAMINED. **China.** TAIWAN: Taipei, University Campus [cult.], *Huang* 2386 (MO). **India.** Hort. Bot. Calcuttensis [cult.], *s. coll. s.n.* (L). **Japan.** BONIN ISLANDS: without locality, 16 Sep 1908, *s. coll. s.n.* (US).—HONSHU: Nara Pref., Matsuyama, Ouda-machi, Uda-gun, *Makino* 71428 (L); Tenjimjima, Yokosuka, Prov. Sagami, Hondo, *Mizushima* 3068 (A).—KYUSHU: Pref. Kagoshima, Prov. Ohsumi, 20 May 1962, *Furuse s.n.* (A); Amakusa Island, Tomioka, 21 Aug 1935, *Kuenberg s.n.* (A); Nagasaki, 1863, *Maximowicz s.n.* (C, GH, K, L, NY, US-2); Tsushima Island, *Mimoro* 1764 (MO); Tsushima, S of Takeshiki, 34°17.5'N, 129°18'W, *Moran* 5573 (US); Nagasaki, *Oldham* 103 (GH, K, L).—RYUKYU ISLANDS: Amami-Oshimas, Uken-son, *Amano* 6443 (US); 21 Oct 1906, *Sakurai s.n.* (A); in ditione Mikasa Kori, prope vicum Faruda Tamaye, *s. coll.* 873 (L).—SHIKOKU: Isl. Shodo, Shodo-gun, Prov. Sanuki, *Satomi* 11334 (A). **Korea.** Hpalkai, *Taquet* 597 (K); without clear locality, *Taquet* 2698 (A), *Taquet* 4139 (A). **U.S.A.** HAWAII: Kauai: Koloa District, Lawai Valley, Natl. Trop. Bot. Gard. [cult.], *Flynn* 6325 (BISH, PTBG, TEX); Honolulu, Kapi'olani Park [cult.], *Lau* 1392 (BISH); Oahu, Haleiwa, Waimea Arboretum and Botanic Garden [cult.], *s. coll. s.n.* (NY, TEX).

The distinctive obovate leaf shape of *T. hamabo* sets it apart from its congeners and makes it readily recognizable. It is the most northerly species of the genus, occurring to at least 34°N latitude. As might be expected, it is also the most cold tolerant. It can be cultivated with impunity in temperate areas where it is regularly subjected to winter freezing temperatures, although there are presumably limits to how prolonged such exposure can be.

12. *Talipariti hastatum* (L. f.) Fryxell, comb nov. *Hibiscus hastatus* L. f., Suppl. Pl. 310. 1781. *Hibiscus tiliaceus* var. *hastatus* (L. f.) Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 4: 63. 1900, nom. illegit. *Pariti hastatum* (L. f.) Degener & Greenwell in Degener, Fl. Haw. Fam. 221. 1957. *Hibiscus tiliaceus* subsp. *hastatus* (L. f.) Borssum Waalkes, Blumea 14: 36. 1966.—TYPE: Tahiti, *Forster s.n.* (holotype: LINN; probable isotypes, fide Borssum Waalkes 1966: BM, K, P).

Hibiscus tricuspis Banks ex Cavanilles, Diss. 3: 152. t.55. f.2. 1787. *Paritium tricuspe* (Banks ex Cavanilles) G. Don, Gen. hist. 1: 485. 1831.—TYPE: SOCIETY ISLANDS. Tahiti, *Forster ?142* (holotype: P).

Hibiscus corrugatus J. W. Moore, Bull. Bishop Mus., Honolulu no. 102: 31. 1933.—TYPE: SOCIETY ISLANDS. Raiatea, near beach, 3.5 mi S of Uturoa, *Moore* 325 (holotype: BISH!; isotype: MO!).

Fig. 2e.

Trees 3–14 m tall, the young stem finely arachnoid-pubescent and with scattered stellate hairs to 0.5 mm long, or glabrescent. Leaf blades variable, narrowly lanceolate, ovate, or more or less 3-lobed (the central lobe the largest and sometimes secondarily lobed), the blade longer than broad (rarely as broad as long), 8–17 cm long, 2–12 cm wide, basally truncate or cuneate (rarely subcordate), the margin subentire or undulate-crenate, apically acute or acuminate (or the lateral lobes obtuse), pedately 7–9-nerved (the midrib separated from two more or less pedate lateral fascicles of nerves), minutely stellate-pubescent beneath, subglabrous above, sometimes with a prominent elongate nectary (6–8 mm long) on the midrib beneath, or foliar nectaries absent; petioles subequal to blades, to 16 cm long, more or less stellate-pubescent; stipules foliaceous, 3 cm long, 1–1.4 cm wide, lance-ovate, erect, sessile and amplexicaul, externally stellate-pubescent (hairs

ca. 0.5 mm long), deciduous, leaving annular scars. Flowers more or less aggregated at the ends of leafless branches, forming 3–6-flowered sympodia; pedicels 1–2 cm long, 3–4 mm thick in fruit; involucre (Fig. 2e) cupuliform, 8–10 mm long (about equaling the sinuses between the calyx lobes), minutely puberulent, ca. 10-toothed, the teeth 3–4 mm long; calyx (Fig. 2e) 2–2.8 cm long, more than half-divided, the lobes triangular, minutely pubescent, 1.5 cm long, 4–7 mm wide at base, with a small nectary on midrib of each lobe; petals 4–6 cm long, 3–4 cm wide, dark reddish, the blade yellow (fading orange or reddish), minutely stellate-pubescent, obovate or sometimes distally erose or deeply lacerate, the claws narrow; staminal column 2 cm long, glabrous, filamentiferous throughout length, the filaments 1–3 mm long; styles emergent from the staminal column, with dense short glandular (?) hairs, the stigmas obliquely capitate, ca. 1 mm in diameter. Capsules obovoid, 1.5 cm long, nearly equaling the calyx, 17–18 mm in diameter, 5-locular, densely and antrorsely hirsute, the hairs ferruginous, 0.5–1 mm long; seeds numerous, reniform, 4 mm long, obscurely and minutely scabridulous (seemingly glabrous). Chromosome number: $2n = \text{ca. } 80$ (Youngman 1927; Longley 1933); $2n = 120$ (Pushparajan et al. 1986).

Phenology. Flowering and fruiting throughout the year.

Distribution. Society Islands; on sandy seashores. Cultivated in tropical Asia (Masters in Hooker, 1872; Paul & Nayar, 1988; Wight & Arnott 1834), Hawaii, and elsewhere. Introduced to Hawaii from Tahiti by G. P. Wilder, according to *Wilder 34* (A).

Illustrations. Bates (1965: 72, fig. 2B); Borssum Waalkes (1966: 37, fig. 6); Cavanilles (1787: t. 55, f. 2).

ADDITIONAL SPECIMENS EXAMINED. **U.S.A.** FLORIDA: Miami, Fairchild Tropical Garden [cult.], *Houghton & White 1125* (MO).—HAWAII: Kauai: Koloa District, Lawai Valley, Natl. Trop. Bot. Gard. [cult.], *Chapin et al. 27* (PTBG, TEX), *Chapin et al. 20* (PTBG, TEX), *Chapin et al. 21* (PTBG, TEX), *Chapin et al. 24* (PTBG, TEX), *Flynn 6326* (BISH, PTBG, TEX). Maui: Maui Zoological and Botanical Garden, from Spreckelsville beach, *Davis & Sylva 11* (BISH). Molokai: beach at One Alii Park, *Pelalo 48* (BISH). Oahu: Honolulu, Girls School [cult.], *Grant 5610* (A, BISH), 25 Sep 1937, *Judd et al. s.n.* (BISH); Honolulu, Kalihi, nursery of Bishop Estate [cult.], 12 Nov 1930, *Judd s.n.* (BISH); Honolulu, Kawaiku'i Park [cult.], *Lau 1398* (BISH); Waimea Arboretum and Botanic Garden, accession no. 74p439 [cult., from Raiatea], *Lau 2814* (BISH); 1930 Ualakaa Street, Honolulu, [cult., from Tahiti], *Wilder 34* (A, BISH). **Trinidad.** Botanic Garden, *s. coll. 158* (US).

India. Hort. Bot. Calcuttensis, *s. d.*, *s. coll. s.n.* (GH).

Fiji. Viti Levu, Tholo North, vicinity of Tavua, *Degener 14967* (A, BISH, MO, NY, TEX, US); without locality, *Seemann 26* (GH). **Papua New Guinea.** NEW BRITAIN: Nodup area, *Waterhouse 307* (NY). **Society Islands.** BORABORA: Vaitape, in village near sea, *Fosberg 12169* (BISH); Dist. Tevaitapu, Popoti, *Grant 5051* (BISH).—MAUPITI: E coast, Maupiti village, *Fosberg 64931* (US).—MOOREA: Côte Est, Vaiare, bord de route près du débarcadère, *Florence 4712* (US).—RAIATEA: Baie d'Opoa, 16°50'S, 151°22'W, *Florence 3518* (US); Opoa, head of Opoa Bay, planted, growing in edge of water, *Fosberg & Sachét 63234* (BISH, MO), planted in rows of trees along road, *Fosberg & Sachét 63237* (BISH).—RAIVAVAE: Village de Rairura (147°40'W, 23°52'S), *Florence & Sykes 11189* (US).—TAHITI: Papeete, Parking de l'OTAC, *Florence 2377* (US); Dist. Hitiaa, beach, *Grant 4502* (A, BISH); Dist. Mataiea, *Grant 4556* (BISH); about 1 mi N of Papeete along shore, *MacDaniels 1697* (BISH, NY, TEX, US); Papeari, Domaine Motu-Ovini, *Maclet 34* (BISH); Papeete (Jardin de Mamao), *Maclet 56* (US); PIRAE (Service Agriculture), *Maclet 88* (US); Papeete, hedge in garden, *Sachét 1406* (US); near Papawa bridge, *Setchell & Parks 156* (BISH, GH, US); Jun 1792, *Smith & Wiles s.n.* (NY); Papeete, seashore, *Wilder 506* (BISH).

The leaf form of *T. hastatum* is highly variable. It commonly has more or less 3-lobed leaves, although it sometimes has unlobed leaves, but then they are narrowly lanceolate rather than broadly ovate. Such leaf lobing is essentially unknown in other species of *Talipariti*. The petals of *T. hastatum* are also distinctive, in that they are

sometimes deeply laciniate (e.g., *Lau* 2814), though this feature, too, is variable in expression. The extended inflorescence (sympodium) is a characteristic that *T. hastatum* shares with *T. potteri*.

A collector's note (*Degener* 14967) says "fibers used in house-building," presumably in reference to bast fibers from the bark.

Borssum Waalkes (1966: 36) states that the holotype of *Hibiscus hastatus* came to be in the Linnean Herbarium at the Linnean Society by a circuitous route, but neither Jackson (1912) nor the IDC microfiche of the Linnean Herbarium indicate the presence of the specimen. Borssum Waalkes also notes that the holotype of *Hibiscus tricuspis* is in the general herbarium in Paris and not in Madrid. Garilleti (1993) verifies (by omission) its absence from Madrid.

13. *Talipariti leeuwenii* (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus leeuwenii* Borssum Waalkes, *Reinwardtia* 4(1): 50, fig. 5. 1956.—TYPE: NEW GUINEA. [INDONESIA. West Irian:] Mamberamo River, Albatros Bivouac, 30 m, *Docters van Leeuwen* 9113 (holotype: BO; isotypes: A! K, L-2!; photo of K isotype: TEX!).

Trees 15–20 m tall, the twigs stellate-pubescent, the hairs ca. 1 mm long. Leaf blades broadly ovate, 6–16 cm long, slightly wider, basally cordate, the margins entire, apically acute, palmately 7-nerved, somewhat discoloured, both surfaces stellate-pubescent, the hairs ca. 0.5 mm in diameter, with a single foliar nectary 4–10 mm long at base of blade; petioles 3–9 cm long, with pubescence like stem; stipules ca. 1 cm long, 0.5 cm wide, stellate-pubescent, sessile and amplexicaul, deciduous, leaving annular scars. Pedicels solitary in the leaf axils, 1–4 cm long, stellate-pubescent; involucellar bracts 6, distinct, cordate-ovate (thus basally plicate), 2.5–3 cm long, 1.5–2 cm wide, acute, sparsely and obscurely pubescent; calyx 2.5–3 cm long (subequal to involucre), densely and minutely stellate-pubescent, more than half-divided, nectaries absent; petals [not seen] "lilac" or "red." Capsules narrowly ovoid, 3 cm long, 1 cm in diameter, 5-angular, acuminate, hirsute with long simple appressed hairs and with minute stellate hairs, "10-locular" [ex descr.], minutely pilose internally; seeds numerous, reniform (distinctly curved), densely pilose, the hairs stellate, ferruginous. Chromosome number unknown.

Phenology. Collected in flower in March, May, and October.

Distribution. New Guinea (see map in Borssum Waalkes 1956: 42, fig. 1); in primary forest at 30 m elevation.

Illustration: Borssum Waalkes (1956: 51, fig. 5).

ADDITIONAL SPECIMEN EXAMINED. **Indonesia.** WEST IRIAN: Mamberamo River, Pioneers Bivouac, 30 m, *Van Eechoud* 44 (=bb.31108) (L).

Talipariti leeuwenii is distinguished by a combination of characters, as is indicated in the key to species.

14. *Talipariti macrophyllum* (Roxburgh ex Hornemann) Fryxell, comb. nov. *Hibiscus macrophyllus* Roxburgh ex Hornemann, *Hort. Bot. Hafn. Suppl.* 149. 1819. *Paritium macrophyllum* (Roxburgh ex Hornemann) G. Don, *Gen. hist.* 1: 485. 1831.—TYPE: Botanic Garden, Calcutta from Chittagong?, *Wallich* s.n. (lectotype, here designated: C!, the sheet labeled "1b"; isotypes: C!, 6 additional sheets).

Hibiscus setosus Roxburgh, Fl. Ind. 3: 194. 1832.—TYPE: Botanic Garden Calcutta, *Roxburgh s.n.* (lectotype, designated by Borssum Waalkes, 1966: BR-herb. Martius).

Figs. 1a, 2c.

Trees 15–25 m tall (sometimes smaller and shrubby), the young stems densely shaggy-hirsute with yellowish stellate hairs to 5–8 mm long simulating simple hairs, and with an understory of smaller stellate hairs. Leaf blades broadly ovate, 5–40 cm long, 4.5–50 cm wide, basally deeply cordate, the margin crenulate to subentire, apically abruptly acuminate, palmately 7–9-nerved, discolorous, coarsely tomentose, more densely so and yellowish beneath, with a nectary on each principal vein beneath positioned $1/3$ – $2/3$ the distance from base to apex, the nectary often obscured by pubescence; petioles 17–35 cm long, with pubescence like stem (especially basally); stipules (Fig. 1a) 3–11 cm long, 1.5–3 cm wide, ovate to scimitar-shaped, sessile and amplexicaul, hirsute (especially externally), deciduous, leaving annular scars. Pedicels axillary, solitary (or sometimes in 2-flowered sympodia), presented horizontally, 1 (–5) cm long, densely hirsute, the subtending leaves reduced to 6–8 cm long; involucl (Fig. 2c) ca. 2.5 cm long, the 8–10 elements nearly distinct, lanceolate or ligulate, ca. 3 mm wide, yellowish hirsute; calyx 2.5–3 cm long, slightly exceeding the involucl, more than half-divided, the 5 lobes each 3-nerved, less densely hirsute than involucl, nectaries absent; petals 4–6 cm long, 2–4 cm wide, yellow with dark red basal spot (fading purplish), glabrous within, externally hirsutulous; staminal column 3–4 cm long, glabrous (?), yellowish, filamentiferous throughout, the filaments 2–8 mm long; anthers yellow, 1.5 mm long; style exceeding staminal column by ca. 8 mm, dividing into 5 purplish red and pilose branches, the stigmas 1.5 mm wide (apparently clavate), minutely pilose. Capsules erect, obovoid, 2.5–3.5 cm long, 18–20 mm in diameter, 5-locular, apiculate or beaked, shaggy-hirsute; seeds numerous, reniform, 4 mm long, with 3 mm ferruginous hairs along edges. Chromosome number unknown.

Phenology. Flowering and fruiting throughout the year.

Distribution. India and the Malay peninsula to Java, the Philippines, and southern China; in secondary forests from the lowlands up to 1400 m, never along the coast. Cultivated and naturalized in Hawaii and perhaps elsewhere. See map in Phuphathanophon et al. (1989: fig. 11) for distribution in Thailand.

Illustrations. Bates (1965: 72, fig. 2E); Degener (1932: fam. 221), Feng (1984: 16, fig. 1); Hu (1955: pl. 19, fig. 7); Phuphathanophon et al. (1989: fig. 10); Wallich (1830, vol. 1: 44. t. 51).

ADDITIONAL SPECIMENS EXAMINED. **Bangladesh.** Chittagong Hill Tracts, Mainimukh on the northern side, *Huq 3184* (L); Chittagong Hill Tracts, Kasalong, *Lister 44* (L). **China.** YUNNAN: Fo-Hai, *Wang 74628* (A); without locality, *Wang 77660* (A). **India.** ASSAM: Naga Hills, Nambor Forest, *Bor 18538* (L); without locality, *Griffith 477* (C, GH, K, L), *Masters s.n.* (L).—NAGALAND: Dinapur Forest, along railroad track, *Srivastava et al. 91664* (MO).—Without locality: “Ind. or.” *Wallich 1905* (L); Hort. Bot. Calcuttensis, *s. coll. s.n.* (L). **Indonesia.** JAVA. Res. Batavia, Warajasa, 630 m, *Bakhuizen van den Brink 4886* (L); Res. Madioen, Oostbank boven Plaosan, 1000–1200 m, *Elbert 188* (L-2); Res. Bantam, Kuala Hills, *Forbes 531* (K); Mt. Salak, cascade du Tjisahat, rochers de la cascade, 620 m, *Hochreutiner 1251* (L); Palabuanratu, *Koorders 4575* (K); Distr. Tjisonhari, Tjigenteng [cult.], *Koorders 4577* (L); Mt. Karang, Kp. Monggos, 1000 m, *Koorders 4578* (L); Distr. Batuhideung, Mt. Pangisisan, *Koorders 4579* (L); Pekalongan: Sirundo (Tjomal), coffee estate Pretigan, *Koorders 11533* (L); Res. Preangu, Palabuanratu, *Koorders 11779* (L); Res. Pekalongan, Subah, *Koorders 14222* (L); southern mountains, Suberlandjing near Kalipare, *Koorders 23451* (L); Res. Bogor, Mt. Salak, Kp. Bumaga, 600 m, *Koorders 24283* (L); Preanger, Pengalengan, 1400 m, *Wind P7* (L); without locality, *Zollinger 1433* (A, L-2); *Blume s.n.* (NY); *Koorders 13553* (K, L).—SUMATRA. Deli-Atjeh border, edge of

mangrove swamp, *Bangham & Bangham* 651 (A, NY); Asahan, East Coast, *Bartlett & La Rue* 209 (GH, L). **Laos.** Vientiane, colline au nord de la digue du réservoir Nam Ngum, *Vidal* 5936 (US). **Malaysia.** KELANTAN: Ulu Kelantan, Sunbgei Ketil, Gua Musang, *Shah & Ali* 2853 (C); Ulu Kelantan, Galas FR, E of Gua Batu Boh, Gua Musang, *Shing FRI* 19272 (A, K).—PAHANG: Maran/Temerloh Road by Sg. Kemak Bridge No. 54/5, *Burkill* 2698 (L-2); Sungai Estates, *Kadim & Mahmood* 105 (L).—PERAK: Gunong Bubu, *Whitmore FRI* 0972 (A, L). —SELANGOR: Ulu Muda For. Res., North Kedah, *Bray* 11784 (L), *Chan* 6739 (K, L); Ulu Gombak, *Stone* 6662 (BISH, L).—TRENGGANU: Ulu Telemong, Bukit Rambai FR., *Suppiah* 11389 (L).—SABAH: Distr. Ranau, Poring Hot Springs at SE base of Mt. Kinabalu, 6°3'N, 116°42'W, *Beaman et al.* 7565 (L, MSC); Kinabalu National Park, en route from Poring Hot Springs and Langanan Waterfall, 600–900 m, *Kokawa & Hotta* 4745 (L); Distr. Ranau, ca. 1 mi N of Kampung Pinawantai, 1600 ft, *Shea & Aban* 76971 (A, L); Distr. Kota Belud, S of Sungei Mentenau, 1000 ft, *Shea & Minjulu* 76302 (L). **The Philippines.** PALAWAN: Baraki, *Fox* 13441 (L); Butaraza, Rio Tuba, at western plains of Bulanjao Range, *Soejarto & Madulid* 8990 (A); Iraan Mountains, Aborlan, 200 m, *Sulit* 12520 (A, L). **Singapore.** Hort. Bot., 9 Jun 1904, *Hallier s.n.* (A, L), Sargent, 28 Oct 1903, *Sargent s.n.* (A-2). **Thailand.** Prachinburi, Sriracha forest, *Collins* 343 (US), *Collins* 796 (K, US), *Collins* 1136 (C, K, US); Satun Province, Tarutao Island, *Congdon & Hamilton* 285 (A); between Krabi and Phang Nga., *Floto* 779 (C-2, K, L); Nan, Doi Tiu, 500 m, *Kerr* 5033 (K-2); Songkla Wang Yai, *Kerr* 14772 (C-2, K-2); Chaburi Prov., Siricha Distr., Kew Kieo, 150 m, *Maxwell* 75-46 (L); Prov. Kanchanaburi, Distr. Sangklaburi, Toong Yai Naresuan Wildlife Reserve, *Maxwell* 94-538 (A); N Rachasima Natl. Park, *Phengkhlai* 622 (C, K, L); Peninsular: Narathiwat, Waeng, *Phusomsaeng* 371 (C, K, L); Kanchanaburi, Southwestern Distr., Khao Yai, E of Sangkhala, *van Beusekom & Phengkhlai* 288 (C, K, L-2). **Vietnam.** Env. de Biên Hoa, Jun 1909, *d'Alleizette s.n.* (L); Prov. Biên hoa, *Pierre* 1109 (A-2, BISH-3, C, K, L-9, MO, NY, P, US). **U.S.A.** HAWAII: Oahu, Honolulu, Degener garden [cult.], *Degener* 9995 (BISH, BRIT, NY, TEX), *Degener* 10331 (BISH, BRIT, GH, L, MO, NY); Oahu, Palama Valley, 1200 ft, (introduced from Samoa), 17 Jun 1936, *Judd s.n.* (BISH, NY); Hau'ula, Papali Gulch, 15 Jun 1989, *Miller s.n.* (BISH); Lyon Arboretum, Middle-Lawn Makai, *Teraoka* 149 (BISH-2); Hauula Valley, completely naturalized in wet forest, *Topping* 3151 (NY); HSPA Forest Nursery, Manoa Valley, *Yuncker* 3565 (NY).

This is perhaps the most distinctive species of the genus and is set apart by a number of characters. Its remarkable pubescence is perhaps the most notable feature, with prominent yellowish hairs 5–8 mm long on the herbage generally. In addition, it has very large stipules (Fig. 1a), distally placed foliar nectaries on relatively large leaves, obovoid capsules, and seeds with the long seed hairs confined to the edges of the seed.

Talipariti macrophyllum is sometimes grown in cultivation and is reportedly used as a source of cordage (*Fox* 13441). A collector's note (*Judd s.n.*) says "Bark used in Samoa for *easina* (Woolly lavalavas)."

15. *Talipariti pleijtei* (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus pleijtei* Borssum Waalkes, *Reinwardtia* 4(1): 46. 1956.—TYPE: NEW GUINEA [INDONESIA. West Irian:] Kadamak, vicinity of Sorong, 50 m, 11 Aug 1948, *Pleijte* 510 (holotype: BO; isotypes: A!, BRI, K, L!, P, PNH, SING).

Fig. 1e.

Trees 13–25 m tall, the trunk buttressed, the twigs angular (ultimately terete), densely and very minutely puberulent or with fimbriate scales, becoming glabrescent. Leaf blades coriaceous, ovate, 7–20 cm long, 4.5–14 cm wide, basally rounded or subcordate, the margin entire, apically short-acuminate, palmately 5-nerved, with scattered minute stellate hairs or fimbriate scales except more densely pubescent on nerves beneath, with a small to elongated nectary (2–10 mm long) 5–10 mm above the base of the blade on midrib beneath; petioles 1–5 cm long, minutely stellate-pubescent or glabrous; stipules (Fig. 1e) 10–25 mm long, 5–18 mm wide, oblong to subrotund, appressed, apically obtuse or acute, with scattered minute pubescence. Flowers solitary in the leaf axils or in terminal 2–10-flowered sympodia,

or these combined into complex inflorescences; pedicels 1.5–2 cm long; involucler bracts 5–6, briefly connate at base, ovate to lanceolate (sometimes revolute?), acute, 8–12 mm long, 3–8 mm wide (or wider), internally minutely pilose, externally with scattered stellate hairs or scales; calyx 12–16 mm long, ca. half-divided, the lobes ovate, acute, externally lepidote, internally minutely stellate-pubescent, ecostate, nectaries absent; petals 2.5–3 (–5?) cm long, 0.5–1 cm wide, red to purple, oblong or ligulate, externally densely lepidote; staminal column 1.5–2 cm long (rarely to 5 cm), densely lanate at base together with base of petals forming a cushion, otherwise glabrous, filamentiferous distally, red to purple, the filaments ca. 2 mm long; styles emergent from the staminal column, distinct for ca. 3 mm, the stigmas capitellate, ca. 1 mm in diameter. Capsules ovoid, 1.5–2 cm long, 1–1.5 cm in diameter, slightly pentangular, acute, externally minutely lepidote, internally densely woolly, “10-locular” [ex descr.]; seeds numerous, reniform, 2.5 mm long, densely pubescent, the hairs ferruginous. Chromosome number unknown.

Phenology. Probably flowering and fruiting throughout the year.

Distribution. New Guinea (Vogelkop Peninsula and adjacent islands); mostly at low elevation in primary and secondary forest but once found (fide Borssum Waalkes, 1966) at 1400 m.

Illustration: Borssum Waalkes (1956: 47, fig. 3).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** WEST IRIAN: Div. West New Guinea, Wersar (ca. 6 km S of Teminaboean), 10 m, *Kalkman 6310* (K); W. New Guinea, Kaloal, Eiland Salawati, 3 m, *Koster 1498* (L); Warsamson River, ca. 25 km E of Sorong, ca. 60 m, *Schram 5965* (L); Warsamson-vlakte, Sorong, *Schram 12330, 12383* (L); Vogelkop Peninsula, Sorong, 400 m, *van Royen 3080* (K); Waigeo Island, N of Sorong, 10 m, *van Royen 5516* (L).

Talipariti pleijtei and *T. sepikensis* are very similar, sharing the characters of relatively small flowers (calyx 1.2–1.6 cm long; petals pink or red) with lanate staminal columns, which set them apart from the remaining species. They are distinguished from each other by the characters given in the key.

- 16. *Talipariti potteri*** (O. Degener & Greenwell) Fryxell, stat. et comb. nov. *Pariti tiliaceum* var. *potteri* O. Degener & Greenwell, Fl. Haw. fam. 221. 1956. *Hibiscus tiliaceus* var. *potteri* (O. Degener & Greenwell) St. John, Mem. Pacific Trop. Bot. Gard. 1: 230. 1973.—TYPE: U.S.A. Hawaii: cultivated; seeds said to have come from Guadalcanal, Solomon Islands, *Degener & Degener 23758* (holotype: not located; isotypes: BISH! US!). Fig. 2j.

Trees to 10 m tall, the young stems minutely stellate-puberulent, the trunks erect (“not straggly [as in *T. tiliaceum*]”). Leaf blades broadly ovate, 8–17 cm long, 6–22 cm wide, basally deeply cordate (the sinus 2–5 cm deep), the margin entire, apically acute or subobtuse, pedately 9 (–11)-nerved, discolorous, the upper surface subglabrous, the lower surface minutely puberulent (soft to the touch), the hairs stellate, whitish, 0.2 mm in diameter; nectaries 3 (–5), elongated, 9–19 mm long, on the principal nerves near base beneath; petioles 2–12 cm long, with pubescence like stem; stipules [not seen] deciduous, leaving curved annular scars. Flowers borne on extended sympodia (with much-reduced leaves), up to 35 cm long with 4–9 flowers each, the sympodia sometimes aggregated distally into a complex inflorescence; pedicels 2–3.5 cm long, curved (ascending from a declined rhachis?), stout (3–5 mm in diameter); involucler (Fig. 2j) cupuliform, 8–10-toothed, basally ribbed (at juncture with pedicel), the teeth subequal to the sinuses of

calyx, triangular, 2–4 mm long, more or less reflexed in fruit; calyx (Fig. 2j) 18–20 mm long, deeply divided, minutely puberulent, each lobe ca. 1.5 cm long, with a prominent midrib and a (sometimes obscure or vestigial) nectary on midrib near center of each lobe; petals 3–6 cm long, 3–5 cm wide, yellow with maroon center, externally densely pubescent, internally glabrous; staminal column ca. 2 cm long, glabrous, filamentiferous throughout, the filaments 1–2 mm long; styles exceeding the staminal column by ca. 1 cm, pubescent, the stigmas capitate. Capsules (Fig. 2j) subglobose, short-beaked, slightly shorter than to subequal to calyx, 1.5 cm long, 1.5–2 cm in diameter, 5-locular (with papery internal dissepiments), densely pubescent, the hairs stellate, yellowish, 0.5 mm long or less; seeds numerous, dark brown, reniform, 4.5–5 mm long, appearing glabrous but minutely papillate. Chromosome number unknown.

Phenology. Collected in flower and fruit in February and from September through October, but the pattern is unclear.

ADDITIONAL SPECIMENS EXAMINED. **Caroline Islands.** Kosrae: Utwe District, coastal road from Utwe to Walag, 1–3 km W of Utwe, *Lorence et al.* 7868 (PTBG). **U.S.A. HAWAII.** Oahu, Mokuleia Beach, Waialua, planted in Degener garden (from type tree), 15 Oct 1957, *Degener & Degener* 24352 (L, US).

According to Degener and Greenwell (1956), *T. potteri* was “Cultivated for curiosity mainly in the arboretum of the Hawaiian Sugar Planters’ Association in upper Manoa Valley, Oahu, and in Foster Botanical Gardens, Honolulu, of which M. Colin Potter is custodian. The seed was brought originally from Guadalcanal by an unknown member of one of the armed services during the Second World War.” During this study no additional material has come to light from Guadalcanal that conforms to this plant, although a recent collection from the Caroline Islands is interpreted as conspecific. *Talipariti potteri* is considered distinctive enough in several characters, most notably its extended sympodial inflorescences, reflexed involucl, and papillate seeds to be recognized at specific rank. The sympodial inflorescences may also be found in *T. hastatum*, *T. pleijtei*, *T. pseudotiliaceum*, *T. sepikensis*, usually in a reduced form, and to a much-reduced extent in *T. tortuosum* and *T. macrophyllum*, but then only 2-flowered. Only in *T. hastatum* and *T. pleijtei* are the sympodia as fully developed as in *T. potteri*, but in these species other characters amply distinguish them.

17. *Talipariti pseudotiliaceum* (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus pseudotiliaceus* Borssum Waalkes, *Reinwardtia* 4(1): 65, fig. 12. 1956.—
TYPE: MOLUCCAS. [INDONESIA. Maluku:] Morotai, Tobelo, northern Tjao, 60 m, 2 Jul 1949, *Tangkilianian (Exp. Kostermans)* 229 = *bb.* 33899 (holotype: BO-116796; isotypes: BO, BZF, K! L! SING). Fig. 2n.

Trees to 22 m tall, the twigs minutely and sparsely stellate-pubescent, perhaps eventually glabrescent. Leaf blades broadly ovate or suborbicular, up to 18 cm long, 20 cm wide, basally deeply cordate (the sinus 2–3 cm deep), the margin entire or minutely denticulate, apically subobtuse to short-acuminate, palmately 7–9-nerved, discolorous, sparsely stellate-pubescent above, densely stellate-pubescent beneath (the hairs ca. 1 mm in diameter), foliar nectaries absent; petioles 5–12 cm long, with pubescence like that of the stem but denser; stipules 2–3 cm long, 1 cm wide, more or less elliptic to oblong, acute, externally stellate-pubescent, internally glabrous, eventually deciduous, the scars annular. Pedicels solitary in

the leaf axils (or in few-flowered axillary racemes?), 1–1.5 cm long, stout (3–4 mm in diameter), densely stellate-pubescent; involucellar bracts (Fig. 2n) 5–7, nearly distinct, 2–2.5 cm long (subequal to calyx), 8–12 mm wide, lanceolate to ovate, stellate-pubescent; calyx 2–3 cm long, densely stellate-pubescent, more than half-divided, each lobe prominently 3-ribbed, nectaries absent; petals 5 cm long [ex descr.], yellow; staminal tube and styles not seen. Capsules ovoid with a small beak, 1.5–2 cm long, 2 cm in diameter, 5-locular, densely yellowish pubescent; seeds numerous, reniform, 4 mm long, papillate. Chromosome number unknown.

Illustration: Borssum Waalkes (1956, fig. 12).

Talipariti pseudotiliaceum is the only species with few (5–8) involucellar bracts that has a yellow corolla. It is known only from the type, collected in primary forest.

Borssum Waalkes (1956, 1966) included this species in a broadly conceived *Hibiscus* sect. *Azanae*, but considered it more closely allied to *H. dalbertisii* than to *H. tiliaceus*. He used the epithet “pseudotiliaceus” in reference to the strong similarity of the stipules of his new species to those of *H. tiliaceus*.

- 18. *Talipariti schlechteri*** (Lauterbach) Fryxell, comb. nov. *Hibiscus schlechteri* Lauterbach, Nachtr. Fl. Deutsch. Schutzgeb. Südsee 316. 1905.—TYPE: “Neu-Mecklenburg: in den Gebirgswäldern bei Punam,” *Schlechter 14658* (holotype: B, destroyed).—PAPUA NEW GUINEA. West New Britain: Pulie River, about 10 mi from mouth, east side, Kandrian Subdist., 06°04'S, 149°12'E, 100 ft, 15 Mar 1966, *Henty & Frodin NGF-27205* (neotype, here designated: NY-2!). Fig. 4.

Trees ca. 12 m tall, the young stems with minute stellate hairs (0.5–1 mm in diameter), these quickly lost leaving obscure lepidote scales (less than 0.5 mm in diameter). Leaf blades broadly ovate, 15–25 cm long, 16–33 cm wide, basally rounded to deeply cordate, the margin entire to obscurely crenulate, apically subobtuse to acute or short-acuminate, palmately 7–9-nerved, discolorous, sparsely pubescent with minute stellate hairs (0.5–1 mm in diameter) or lepidote scales (0.3 mm in diameter) on both surfaces; with an elongate nectary, 9–18 mm long, near the base of the midrib beneath; petioles 6–17 cm long, with pubescence like stem; stipules 2.5–3 cm long, 1–1.5 cm wide, broadly ovate-sessile, basally auriculate, acute, densely stellate-pubescent externally, deciduous, leaving annular scars. Pedicels solitary in the leaf axils, 10–14 cm long, minutely and obscurely lepidote (like stem), 3–7 mm in diameter (increasing distally); involucellar bracts 5–7, these ovate with a narrowed base, ca. 3 cm long, 1–2 cm wide (somewhat unequal in size), sparsely lepidote, entire, acute, degree of distinctness unknown; calyx 5–5.5 cm long, densely lepidote, deeply divided, more or less ecostate, nectaries evidently absent; corolla [not seen] “bright red, slightly contorted/whorled with pale centre; underside of petals with brown scales”; staminal column and styles not seen. Capsules 4–4.5 cm long, 5-locular, dehiscent, externally lepidote and/or stellate-pubescent (the available specimens badly weathered); seeds (not seen) described as “densely brown-pilose.”

Distribution. Known only from the island of New Britain, Papua New Guinea.

ADDITIONAL SPECIMENS EXAMINED. **Papua New Guinea.** West New Britain: Kandrian Subdistrict, Alimbit River, 06°05'S, 149°35'E, standing at water's edge in fresh water reach of river, 8 Oct 1965, *Gillison NGF-22479* (K).—South New Britain: near Urin, 05°43'S, 149°05'E, 50 ft, *White NGF-10011* (CANB).

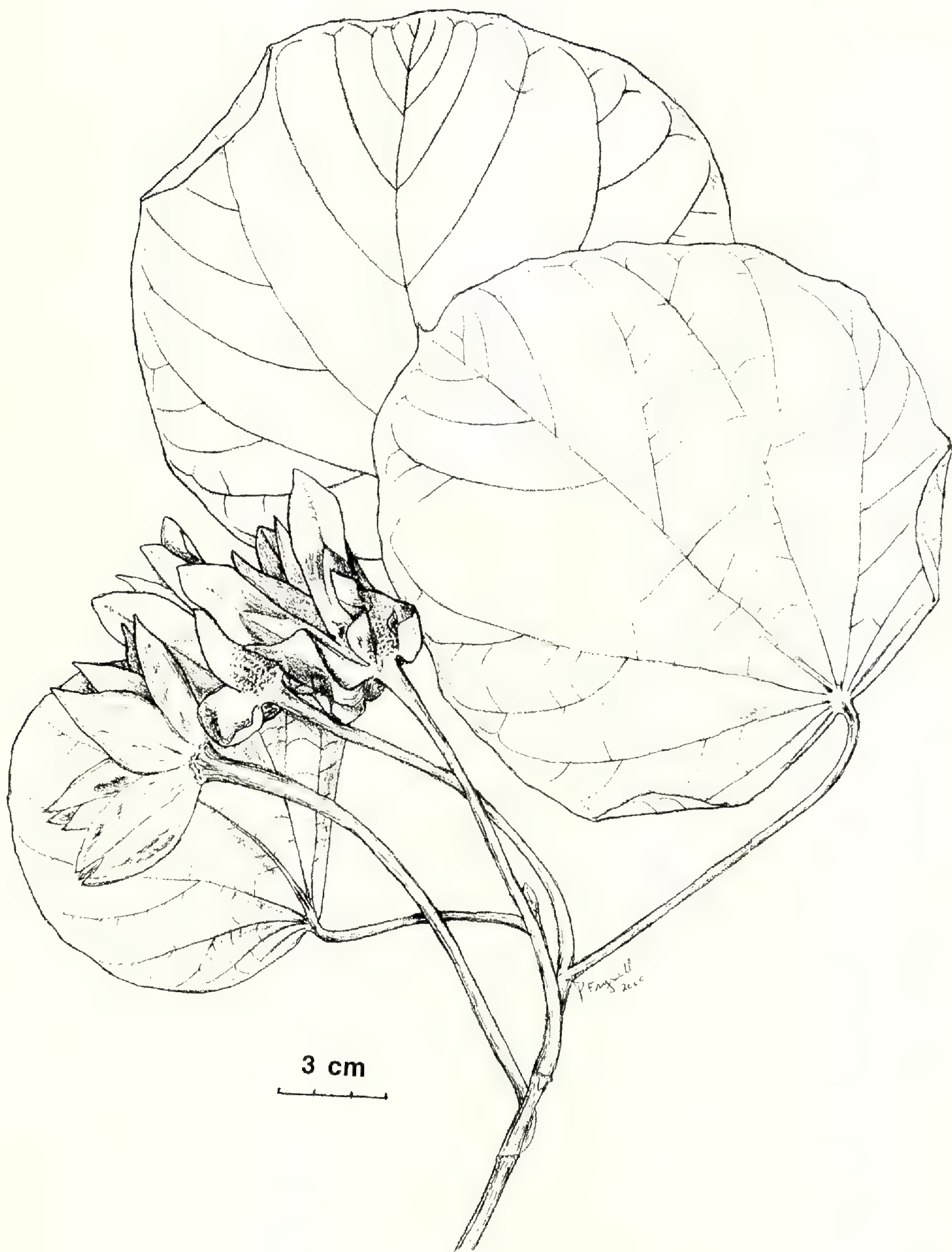


FIG. 4. *Talipariti schlechteri*. Fruiting branch (Gillison NGF-22479).

This species stands out for its very large calyces and fruits and for its elongated pedicels, especially in a genus otherwise characterized by relatively short pedicels (with the additional exception of *T. glabrum*). The red flowers, described by Borssum Waalkes (1966) as “in sicco dark red, in vivo yellow” (a description apparently taken from the protologue), lepidote pubescence, and the nature of

the involucler indicate an alliance with *T. archboldianum*, and indeed Borssum Waalkes (1966) kept *T. schlechteri* only provisionally distinct from this species; however, it may be distinguished from *T. archboldianum* by its larger leaves, stipules, pedicels, and fruits, and by the presence of a large foliar nectary. The auriculate stipules and very long pedicels appear to be unique features of *T. schlechteri*. The collections studied differ slightly in pubescence; the *Gillison* specimen is covered with minute lepidote scales and the *Henty & Frodin* specimen by minute stellate pubescence. In spite of this slight difference they are deemed to be conspecific.

The holotype was kept at the Berlin herbarium and was destroyed. No isotypes were indicated to exist by Borssum Waalkes (1966), whose study of the Malesian Malvaceae kept in European herbaria was very thorough. It is presumed, therefore, that no isotypes exist, and that the designation of a neotype is appropriate. The *Henty & Frodin* specimen (NGF-22479) is selected, because it agrees with the protologue in pubescence type.

The elongated pedicels are so unusual that they invite comparison with those of several species of the genus *Wercklea*, notably *W. woodsonii* (A. Robyns) Fryxell (Fryxell 1981, figs. 27 and 28); this similarity is further discussed above under "Generic Affinities."

- 19. *Talipariti sepikense*** (Borssum Waalkes) Fryxell, comb. nov. *Hibiscus sepikensis* Borssum Waalkes, *Blumea* 14: 46. 1966.—TYPE: PAPUA NEW GUINEA: [West] Sepik District, *Darbyshire & Hoogland* 8234 (holotype: L!; isotypes: A! K!). Figs. 1g, 2l.

Trees 15–19 m tall, the twigs terete, minutely lepidote becoming glabrescent. Leaf blades coriaceous, ovate, elliptic, or subobovate, 6–18 cm long, 4.5–11.5 cm wide, basally rounded to cordate, the margin entire, apically short-acuminate, palmately 5-nerved, minutely lepidote above and beneath, the midrib beneath with an elliptic nectary near the base; petioles 1.5–8 cm long, minutely lepidote; stipules (Fig. 1g) 7–10 mm long, 5 mm wide, broadly ovate, acute, appressed to the stem to spreading, deciduous (sometimes tardily so). Flowers in few-flowered sympodia in the upper axils; pedicels 1.5–2 cm long at anthesis, accrescent to 2.5 cm in fruit, minutely lepidote, sulcate when dried; involucellar bracts (Fig. 2l) 5, nearly distinct, 5–7 mm long, 5–8 mm wide, ovate, shortly acuminate, externally minutely and sparsely scaly, internally glabrous; calyx (Fig. 2l) ca. 15 mm long, half-divided, the lobes 5–6 mm wide, ovate, acute, externally lepidote, internally stellate-puberulent, nectaries apparently absent; petals 3–4 cm long, 1 cm wide, pink, oblong, externally densely lepidote, stellate pubescent on margins of claw; staminal column ca. 1.5 cm long, densely lanate at base (together with the petal bases forming a cushion), filamentiferous in the upper portion, the filaments 2–3 mm long; styles emergent from the staminal column, glabrous, free for distal 5 mm, the stigmas capitate, 1–1.5 mm in diameter. Capsules [immature] ovoid, acuminate, densely lepidote, "10-locular" [ex descr.]; seeds reniform ca. 3 mm long, densely lanate. Chromosome number unknown.

Distribution. Papua New Guinea; "along creek in garden regrowth and on riverbank"; below 200 m

Phenology. Collected in flower and fruit from July through August.

ADDITIONAL SPECIMENS EXAMINED. **Papua New Guinea.** WEST SEPIK: Aitape Subdistr., near Wnatipi village, on Bliri River, 650 ft, *Darbyshire & Hoogland* 8350 (A, L).

Talipariti sepikense is very similar to *T. pleijtei*, but they are sufficiently different to be accepted as distinct. In addition to the characters given in the key, *T. sepikense* has herbage that is more prominently lepidote than that of *T. pleijtei*.

20. *Talipariti simile* (Blume) Fryxell, comb. nov. *Hibiscus similis* Blume, Bijdrag 2: 73. 1825. *Paritium simile* (Blume) G. Don, Gen. hist. 1: 485. 1831. *Hibiscus tiliaceus* var. *similis* (Blume) Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 15–16: 244. 1912. *Hibiscus tiliaceus* subsp. *similis* (Blume) Borssum Waalkes, Blumea 14: 33. 1966.—TYPE: INDONESIA. Java, *Blume s.n.* (lectotype, designated by Borssum Waalkes, 1966: P). [Authentic material was not found at L, fide Borssum Waalkes 1966, p. 34.]

Hibiscus tiliaceus var. *hirsutus* Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 4: 64. 1900.—TYPE: INDONESIA. Java. Tjikoja, cr. in graminosis prope Buitenzorg, *Zollinger 132* (lectotype, designated by Borssum Waalkes, 1966: G; isoelectotypes: BM, FI, L-2!, P).

Hibiscus tortuosus Wallich ex Prain, Bengal pl. 1: 268. 1903, non *Hibiscus tortuosus* Roxburgh, 1832. *Hibiscus prainii* Raizada & Chatterjee, Sci. & Cult. 26: 47. 1960.—TYPE: INDIA. *Wallich 1913.A* (holotype: CAL; isotype: K-W, labeled “1913.1”).

Fig. 2d.

Trees to 20 m tall, the younger stems with minute arachnoid hairs and larger stellate hairs 1–1.5 mm long, the stems eventually glabrescent and purplish. Leaf blades ovate, 6–20 cm long, 5–24 cm wide, basally deeply cordate, the margin finely crenate-undulate to subentire, apically acute or acuminate, palmately 5–9-nerved, discolorous, the upper surface sparsely pubescent with scattered stellate hairs 0.5–1 mm in diameter, the lower surface whitish, the surface obscured by dense stellate pubescence, the hairs yellowish on the nerves; foliar nectaries 3–7, elongate, 5–25 mm long or sometimes even longer on midrib, and positioned distally on principal nerves, 1/3–2/3 the distance from base to apex of blade; petioles 4–11 cm long, half length of blade or less (sometimes longer), with pubescence like stem; stipules lance-oblong, sometimes asymmetrically so, 5–7 cm long, 1–1.5 cm wide, acute, externally stellate-hirsute (the hairs somewhat coarser than on the blade), internally strigose, the hairs mostly simple and antrorse, ca. 1 mm long, sometimes glabrous (e.g., *Pieters 2533*), deciduous, leaving annular scars. Flowers subsessile between a pair of reduced stipules, often borne on an elongated lateral branchlet and thus appearing long-pedicellate; involucre (Fig. 2d) cupuliform, 15–18 mm long (ca. half length of calyx), densely yellowish pubescent, ca. 10-toothed, the teeth 7–10 mm long, narrowly triangular; calyx (Fig. 2d) ca. 3 cm long, densely yellowish pubescent, nectaries very obscure or absent; petals 5–7 cm long, 3–4 cm wide, yellow with red center, more or less stellate-pubescent, the margin of claw hirsute; staminal column 3.5 cm long, glabrous, filamentiferous throughout, the filaments 2 mm long; styles and stigmas emergent from the staminal column, purplish, stigmas obliquely capitate, ca. 1 mm diameter. Capsules (Fig. 2d) ovoid (not beaked), ca. 2.5 cm long, ca. 2 cm in diameter, 5-locular, antrorsely hirsute; seeds not seen. Chromosome number unknown.

Phenology. Probably flowering throughout the year; fruits seldom seen, with abortive seeds.

Distribution. India, the Malay Peninsula, Sumatra, Java, and Borneo. “Lowlands and mountains up to ca. 1400 m in or near inhabited places, occasionally in

secondary vegetation, possibly as a relict of cultivation; never along or near the coast" (Borssum Waalkes 1966, p. 34).

ADDITIONAL SPECIMENS EXAMINED. **Indonesia.** JAVA. Buitenzorg, Tabanabon, 450 m, *Bakhuizen van den Brink* 7802 (L); Oudemansgracht te Buitenzorg, *Harreveld* 2537 (L); without locality, *Jung-huhn* 191 (L-2); Res. Preanger, Pangentjongan, NW Mt. Glunggung, 1300 m, reafforestation, *Koorders* 10972 (L-2); [cult.], *Koorders* 13558 (L-2); Pekalongan (Res.), Subah, *Koorders* 13563 (L-2); Res. Semarang, Kedungdjati, *Koorders* 25127 (L), 25339 (L). Res. Benkam, Pangissisan, *Koorders* 4566 (L); Buababu, 700 m, *Popta* 324 (L-2). Hort. Bot. Bogor., 1867, *Teijsmann s.n.* (L-2).—KALIMANTAN: Duersin, *Korthals s.d.*[1836?], *s.n.* (L-3).—SUMATRA. West coast between Panti and Lubuk Sikaping, 400 m, *Borssum Waalkes* 1780 (L-2); without locality, 150 m, *Granhoff* 263 (L); Lamponges, Sepoetik, *Pieters* 2533 (L). **Malaysia.** NEGERI SEMBILAN: Kg. Sungai Layang, *Chin & Mustafa* 3295 (BISH, MO).

Prain (1903), Raizada and Chatterjee (1960), and Borssum Waalkes (1966) consider *T. simile* a hybrid of *T. macrophyllum* and *T. tiliaceum*. It is intermediate between the two species in most characteristics (cf. Figs. 2c, d, and i), and shows the distinctive distal positioning of the foliar nectaries that is also found in *P. macrophyllum* but in no other species of the genus. Its abortive seeds support the interpretation of hybridity. The question of how it propagates and maintains itself in nature, if it is characterized by sterility, remains unanswered. Borssum Waalkes (1966: 34) says "Presumably [it] does not really occur wild. It is often planted as a shade tree in the area," and many (most?) specimens are noted by their collectors as cultivated. It is propagated vegetatively (by cuttings) according to Koorders and Valetton (1895).

Use of the bark for rope is reported on a collector's label (*Koorders* 10972).

- 21. *Talipariti tiliaceum* (L.) Fryxell, comb. nov. *Hibiscus tiliaceus* L., Sp. pl. 694. 1753. *Paritium tiliaceum* (L.) St.-Hilaire, Fl. Bras. Merid. 1: 256. 1828.—**
TYPE: Herb. Hermann, vol. 3, fol. 51, *Linnaeus* no. 258 (holotype: BM).

Figs. 1b, 2i, 5.

Shrubs or trees 3–8 m tall, often with low spreading branches, the stems minutely and softly pubescent (to glabrescent), the hairs stellate and subarachnoid. Leaf blades coriaceous, broadly ovate (sometimes obscurely pentagonal), mostly 6–13 cm long, slightly wider than long, basally deeply cordate, the margin entire to obscurely denticulate or crenulate, apically short-acuminate, discolorous, glabrate above, minutely and densely stellate-pubescent beneath to nearly glabrous, palmately or pedately 7–9-nerved, the veins raised beneath, the principal (1–5) veins abaxially with a nectary at the base of each, the nectaries 2–7 mm long; petioles 4–12 cm long (commonly subequal to the blade), with pubescence like stem but often denser, especially distally; stipules (Fig. 1b) 1.5–4 cm long, 8–14 mm wide, oblong-lanceolate, sessile and amplexicaul enclosing the apical bud, acute, many-veined, stellate-puberulent externally, glabrous internally, deciduous, leaving annular scars. Flowers solitary in the axils (or aggregated distally with reduced leaves); pedicels 0.5–3 cm long (above the articulation), often congested at the apices of the branches, minutely stellate-pubescent; involucl (Fig. 2i) cupuliform, half length of calyx or less, obscurely puberulent, 8–12 (–20)-dentate, the teeth 1–6 (–20) mm long, triangular to lanceolate, the sinuses broadly rounded; calyx (Fig. 2i) 1.5–2 cm long, densely stellate-pubescent, more than half-divided, the lobes lanceolate-acute, 12–15 mm long, 6–8 mm wide, with a nectary medially positioned on midrib of each lobe (nectaries sometimes absent); corolla yellow

(fading orange, sometimes drying dark greenish) with or without a red center, the petals 4–6 (–8) cm long, externally densely and minutely pubescent, internally glabrous; staminal column 2.5–3 cm long, glabrous, pallid, surmounted by 5 triangular teeth, filamentiferous nearly the length of the column, the filaments 1–3 mm long; styles emergent from staminal column, stigmas 5, capitate, 2 mm in diameter, purplish. Capsule subglobose or slightly obovoid, subequal to calyx, 1.5–2 cm long, 1.5–2 cm in diameter, 5-locular, densely antrorsely pubescent, the hairs yellowish or brownish; seeds numerous, 4 mm long, minutely papillate. Chromosome number (var. *tiliaceum*): $2n = \text{ca. } 80$ (Skovsted 1941), $2n = \text{ca. } 92$ (Skovsted 1935), $2n = 96$ (Skottsberg 1955; Youngman 1927).

Phenology. Probably flowering and fruiting throughout the year, unless a dry season induces a hiatus.

The most difficult problem in dealing with the taxonomy of *Talipariti* is how to interpret *T. tiliaceum* sensu lato. It is a highly variable taxon but may be only imperfectly subdivided into constituent taxa. I have taken a middle road here, recognizing where possible the clearly distinct taxa in specific rank (e.g., *T. hastatum*, *T. hamabo*, *T. crestaense*, etc.) but not submerging all of the yellow-flowered representatives into an olio called *T. tiliaceum*, as some authors have done. Even with the clear-cut segregates removed, what remains is highly variable and not easily interpreted. On the one hand, the neotropical material of this complex is relatively uniform and fairly readily characterized. On the other hand, the paleotropical material (including some introductions into the New World in cultivation) retains a great deal of variability, including many of the character states that are common in the neotropical plants. Therefore, the neotropical plants are recognized in infraspecific rank as *T. tiliaceum* var. *pernambucense*, and the name *T. tiliaceum* var. *tiliaceum* is reserved for the highly variable residuum. Future studies of these plants may reveal a pattern in the variability that has not yet been discerned. This distinction between the New and Old World representatives was already noted by St. Hilaire (1828). When he proposed the combination *Paritium tiliaceum*, he expressed doubt that the plant he was describing from Guaratuba, Brazil (at the border of the provinces of São Paulo and Santa Catarina), was the same as the Old World species of Linnaeus, and suggested that it might be a variety of this species or even a distinct species.

Indeed, there are probably additional as yet unrecognized species (or infraspecific taxa) hidden within the residual variability of what is here treated as var. *tiliaceum*. For example, there are two specimens with distinctively trilobulate, deeply cordate leaves (Marianas Islands, Rota, *Evans 2020* [US]; and Caroline Islands, Woleia Atoll, *Alkire 28* [US]) that are unlike anything otherwise seen in leaf form in a broadly conceived *T. tiliaceum*. They clearly pertain to *Talipariti* on the basis of the foliar nectaries and stipule scars; however, both are sterile specimens, and their evaluation, therefore, awaits the collection of additional, fertile material. It is also possible that this leaf form is merely a manifestation of the sterile condition. Field studies will probably be necessary to evaluate this possibility. Christophersen (1935: 143) notes that “Dr. F. B. H. Brown has drawn my attention to the growth in the Marquesas Islands of crenate, glabrate leaves on sterile branches of trees which otherwise have entire, densely tomentose leaves. This species [*T. tiliaceum*] is variable with little constancy in its variations. Its polymorphic features will add to the difficulties of a satisfactory classification.”

One interpretation of this distributional pattern is that the relatively uniform var. *pernambucense* may be a recent introduction from the Old World that spread

throughout the Americas without diversifying significantly. Its uniformity may exemplify the founder effect of a unique dispersal event. An alternative interpretation is that the New World material was at some time introduced into the Old World, and that interbreeding and hybrid swarms gave rise to the very high level of variability that now characterizes the paleotropical region. Evidence to distinguish between these two alternatives is not in hand at the present time.

KEY TO THE VARIETIES OF TALIPARITI TILIACEUM

Corolla yellow with prominent red center; stipule scars nearly straight or slightly curved; epidermis of involucre and stipules visible through pubescence. 21a. *T. tiliaceum* var. *tiliaceum*.

Corolla yellow without red center; stipule scars markedly curved; epidermis of involucre and stipules obscured by pubescence. 21b. *T. tiliaceum* var. *pernambucense*.

21a. *Talipariti tiliaceum* var. *tiliaceum*.

Hibiscus circinnatus Willdenow, Enum. pl. hort. berol. 735. 1809. *Paritium circinnatum* (Willdenow) G. Don, Gen. hist. 1: 485. 1831.—TYPE: ex Hort. Schoenbr. 1804 (holotype: B-W no. 12862!).

Hibiscus porophyllus Vellozo, Fl. Flum. 7: pl. 28. 1825 [1829].—TYPE: Vellozo's plate no. 28 (lectotype, here designated).

Hibiscus tiliaceus var. *purpurascens* Seemann, Fl. Vit. 18. 1865.—TYPE: FIJI. Somosomo, Taveuni, 1860, *Seemann 24* (holotype: K!; isotypes: GH! K!).

Pariti tiliaceum f. *albiflorum* O. Degener & Greenwell, Fl. Haw., fam. 221. 1956.—TYPE: U.S.A. Hawaii. Oahu, Honolulu, 1930 Ualakaa St., from slip of plant brought from Paparua Distr., Tahiti, 24 May 1933, *Wilder s.n.* (holotype: BISH!).

Distribution. Shores of the Indian Ocean and western Pacific Ocean; at or near sea level on riverbanks or in mangrove associations, sometimes at higher elevation (e.g., *Craven & Schodde 104*); sometimes cultivated elsewhere in the tropics. Merrill (1920) disputed the ideas of Cook and Cook (1918) concerning the distribution of *H. tiliaceus* and the role played by humans in achieving its "pan-tropical" range. The authors, however, were unaware that the Old World and New World plants are in fact two distinct taxa, vicariads, and that transport from the paleotropics to the neotropics (or vice-versa) had in fact not occurred, at least not in terms of humans transporting cultivated plants.

Illustrations. Bates (1965: 72, fig. 2A); Feng (1984: 16, figs. 2–3); Hochreutiner (1955: 17, fig. IV, 3–5); Hu (1955: pl. 19, fig. 6); Li (1963: 546, fig. 211); Marais & Friedmann (1987: 28, pl. 7, figs. 4–5); Ngwe (1971: 238, fig. 30); Sivarajan & Pradeep (1995: 92, fig. 28); Walker (1950, fig. 127); Wight (1838: pl. 7).

ADDITIONAL SPECIMENS EXAMINED. **China.** HAINAN: Taiping, *Gressit 1094* (MO); Yaichow, *How 70884, 70460* (MO).—HONG KONG: Lantau Island, Tungchung and vicinity, Taipo, *Taam 1736* (US).—KWANGTUNG: Honam Island, *Levine 957* (MO).—TAIWAN: Koken, prov. Kagi, *Wilson 9906* (US). **India.** Calcutta, Royal Botanic Garden [cult.], *Raizada 21717* (MO); E. Bengal, Gaghkali River, Kurishkool, *Sinclair 3964* (US). **Indonesia.** JAVA: Karimondjava Island, near coast, *Hoogerwerf 67* (BISH); Pasirputih, *Fosberg 39740* (BISH).—SUMATRA: Enggano Island, Boea-Boea, *Lütjeharms 3878* (BISH). **Japan.** BONIN ISLANDS: Iwojima, Motoyama, *Ono 193654* (MO); Ogasawara [Bonin] Islands, Chichijima, Kominato Beach, *Woolliams & Tannowa 15* (PTBG).—RYUKYU ISLANDS: Taketomi Shima, near Aibaru Saki, *Fosberg 37580* (US); Nikao Jima, N of Yaabari, 2.3 km ESE of Hirara, *Fosberg 38198* (US). **Singapore:** Labrador Nature Reserve, 0.5 mi W of Tandjong Borlayer on south coast, *Canright 1037* (ASU, TEX); Kampong Pulau Damar, *Sinclair 5285* (US). **The Philippines:** LUZON: Cagayan, Bagio Cove, *Allen 144-81* (BISH); Mt. Province, Amganad, Banaue, *Conklin & del Rosarie*

72423 (K, PNH); Mt. Province, Putan, Banaue, Ifugao, *Conklin & Buwaya I-864* (PNH), *Newell 5* (PNH); Prov. Bataan, Lamao River, along beach, *Williams 197* (NY, TEX).—QUEZON: Real, Kinabubaker, *Rojo 145* (MO).

Australia. NORTHERN TERRITORY: between coastal dune and mangrove, *Latz 3261* (MO); Berry Springs (12°42'S, 131°0'E) on creekbank, *Must 1339* (CANB, DNA, MO); Wessel Islands (11°11'S, 136°44'E).—QUEENSLAND: Rockhampton, *Dietrich 406* (MO); Russell River, National Park Reserve 1353, 17°16'S, 145°56'E, 2 m, at edge of swamp along river, *Gray 2188* (MO); Green Island, Sand Cay, north beach crest, 16°46'S, 145°54'E, *Stoddart 4242* (US); Cook Distr., Great Barrier Reef Islands, low wooded island, 15°05'S, 145°23'E, *Stoddart 4580* (MO).

Papua New Guinea. BOUGAINVILLE. Bougainville island, near Koniguru, ca. 10 mi N of Buin, *Craven & Schodde 104* (US).—D'ENTRECASTEAUX ISLANDS: Milne Bat Distr., Bolu Bolu, Goodenough Island, 20 m, *Brass 24423* (US).—MADANG: Distr. Bogia, Laing Island, 04°10'25"S, 144°52'20"E, *Iserentant 9018* (BR, MO).—NEW IRELAND: Cape entrance, North Coast, Lavongai (New Hanover) subdistr. Lamet, 02°22'S, 150°12'E, *Croft & Lelean 65381* (LAE, MO).—WEST NEW BRITAIN: SW of Gilnit, on W side of Itni River, Talasea, 05°45'S, 148°32'E, *Frodin NGF-26234* (NY).

Caroline Islands. Woleia Atoll, Falalis Inlet, *Alkire 7* (US), *Alkire 27* (US); Kusaie, Lela Island, *Fosberg 26682* (US); Ponape, Agric. Exper. Sta. grounds, *Glassman 2565* (US). **Fiji.** Makodronga Island, *Degener & Ordoñez 13804* (NY); Kandavu, Namalata Isthmus region, *Smith 16* (NY); Koro, coastal thickets, *Smith 1081* (NY); Fulanga, coastal thickets, *Smith 1223* (NY); Viti Levu, Mba, shores of Mba River near its mouth, *Smith 4741* (NY); Ngau, shore of Herald Bay, vicinity of Sawaeicke, *Smith 7947* (NY); Viti Levu, Serua, coastal strip near Ngaloa, *Smith 9683* (NY); Viti Levu, Suva Point, *Weiner 71-7-49* (BISH); without locality, *Wilkes s.n.* (NY). **Kiribati.** Phoenix Islands, Central Pacific, Canton Island [cult.], *Fosberg & Stoddart 54900* (NY, TEX); Bikenibeu Island, Tarawa Atoll, in village [cult.?], *Herbst & Allerton 2666* (PTBG). **Maldives.** Addu Atoll, Gan Island, seashore, *Sigee 5* (US). **Marianas Islands.** Sariguan, gulley behind village, *Evans 2364* (US); Anatahan, vic. of beach near NW tip of island, *Evans 2459* (US); Rota, Rota (Sonson) and vicinity, alt. 1–10 m, *Fosberg 25073* (MO); Saipan, Tanapag, edges of mangrove swamp, *Fosberg 25263* (US). **Marquesas Islands.** Hu'ei vicinity, between Hanavave and Omoa, *Decker 2450* (MO); Fatu Hiva, W edge of Omoa village, along Vaitopii River near ocean, *Lorence & Wagner 6220* (PTBG). **Samoa.** Ta'u, just W of Fiti'uta, *Whistler 7906* (PTBG). **Society Islands.** Maupiti Island, saddle between Mt. Taharae and Rocher Hotumuatae, *Fosberg 64955* (MO); Tahiti, Distr. Papenoo, *Leland et al. 73* (MO); Raiatea, 3rd valley S of Faaroa Bay, *Moore 236* (MO); Mopelia Atoll, *Sachet 917* (MO). **Tonga:** Sopo, W of Nuku'alofa, near beach, *Yuncker 15027* (NY, TEX, US).

Ivory Coast: Azuretti, on beach E of Abidjan, *Fosberg 40622* (US). **Kenya:** Kwale Distr., Funzi Island, *Frazier 1012* (US). **Liberia:** Sinoe Co., Kru Fishtown, *Baldwin 11612* (US). **Madagascar:** Antsiranana, Nosy-Be, 13°24'30"S, 48°18'15"E, *Antilahamena 214* (MO, TEX); Antsiranana, Nosybe, Lokobe Reserve Integrale, 13°25'25"S, 48°18'48"W, *Malcomber & Antilahimena 2665* (LL, MO). **Mauritius.** Pointe Butte aux Sables, 19°59'S, 57°38'E, *Sauer 2731* (US). **Natal:** Distr. Durban, *Rudatis 1510* (US). "South Africa" [Natal?], *Krause 78* (MO). **Seychelles.** Aldabra Island, West Island, Anse Var, *Fosberg & McNae 49648* (US), *Stoddard 945* (US); Cousin Island, *Fosberg 52170* (US).

U.S.A. FLORIDA: Dade County, Rte. 1 just N of SW 304th Street [cult.], *Hill 16064* (NY, TEX).—HAWAII: Molokai, Kamalo Gulch, *Degener 6046* (MO); Kauai, along the Hanapepe River, *Heller 2203* (MO); Pacific Tropical Botanic Garden, Lawai Valley, upper Four-House Canyon, *Herbst 2331* (MO); Kau District, Hawaii Volcanoes National Park, near Volcano House Hotel [cult.], *Lorence 6331* (PNBG); Oahu, s. loc., *Mann & Brigham 86* (MO); Oahu, Waimea Arboretum [cult., ex Raiatea], *Simon 74P477* (BISH). **Brazil.** Rio de Janeiro, cultivada à beira da Lagoa Rodrigo de Freitas, em frente à Sociedade Hípica Brasileira, *Carauta 617* [6249] (TEX); Rio [de Janeiro], *Glaziou 18887* (US). **Peru.** LORETO: Iquitos, cultivated in park, *Killip & Smith 29827* (US); near Iquitos, *Williams 1302* (US). **Bolivia.** SANTA CRUZ: W side of Santa Cruz, 17°47'S, 63°12'W, cultivated ornamental tree, *Nee 36366* (NY, TEX).

In commenting on Seemann's var. *purpurascens*, Gray (1862) noted: "Nothing in the specimens to distinguish them from *P. tiliaceum*," to which Seemann responded "But the habit of the tree is very different, and the leaves have a purplish hue which they loose [sic] in drying. The natives call it the "red" Vau (Vau damu damu)." I have seen photographic images on the internet of purple-leaved forms cultivated in Tahiti (courtesy of Dick Johnson) that may well be what Seemann (1865) described. The purple foliage is indeed distinctive, but such variants have been selected in many cultivated plants, and that characteristic alone does not

merit taxonomic recognition. Seemann's reference to a different habit of the trees is not borne out by the photographs I saw.

The bark of var. *tiliaceum* is used for fiber (Fosberg 26682) and in weaving (Alkire 7) and the wood for various uses, including making outriggers (Fosberg 26682), canoes (Alkire 27), and fence posts (Craven & Schodde 104). The leaves are used medicinally for wrapping of bone fractures (Weiner 71-7-49).

21b. *Talipariti tiliaceum* var. *pernambucense* (Arruda) Fryxell, comb. nov. *Hibiscus pernambucensis* Arruda, Diss. Pl. Brazil 44. 1810. *Paritium pernambucense* (Arruda) G. Don, Gen. hist. 1: 485. 1831 [as "*Paritium pernambucense* (Bertoloni) G. Don"]. *Hibiscus tiliaceus* var. *pernambucensis* (Arruda) I. M. Johnston, Sargentia 8: 196. 1949 [as "*Hibiscus tiliaceus* var. *pernambucensis* (Bertoloni) I. M. Johnston"]. *Hibiscus tiliaceus* subsp. *pernambucensis* (Arruda) Castellanos, Sellowia 19: 50. 1967.—TYPE: BRAZIL. Pernambuco (holotype: unknown).—BRAZIL. Paraná: Mun. Guaratuba, Boa Vista, beira Rio Sai-Guaçu, Oliveira 229 (neotype, here designated: US!; isoneotype: MBM).

Hibiscus bracteosus DC., Prodr. 1: 455. 1824.—TYPE: Icones Florae Mexicanae s.n.! (Torner Collection acc. no. 6331.1001, Hunt Institute). Cf. copy at G, as photo F-30502.

Hibiscus arboreus Hamilton, Prodr. Pl. Ind. Occid. 49. 1825.—TYPE: GUADELOUPE. Desvaux s.n. (holotype: P).

Hibiscus fragrantissimus Sessé & Mocino, Pl. Nov. Hisp. 113. 1889.—TYPE: MEXICO. Sinaloa: Mazatlán (holotype: unknown).

Pariti tiliaceum f. *immaculatum* O. Degener & Greenwell, Fl. Haw. fam. 221. 1956. *Hibiscus tiliaceus* f. *immaculatus* (O. Degener & Greenwell) St. John, Mem. Pacific Trop. Bot. Gard. 1: 230. 1973.—TYPE: U.S.A. Hawaii. Kauai, Kipukai, Jul 1948, Waterhouse 24014 (holotype: BISH?; isotypes: BISH!, US!).

Fig. 5.

Distribution. Neotropics; in coastal habitats such as riverbanks and mangrove associations.

Additional illustrations. Cervantes Aceves (1992: 153, fig. 38), Chiea & Silva 1992, figs. 1-4), Fryxell (2000: 198, fig. 124, as *H. pernambucensis*), Little & Wadsworth 1964: 327, fig. 150, as *H. tiliaceus*); Meninger (1962: pl. 198* as *H. tiliaceus*), Robyns (1966: 503, fig. 1, as *H. tiliaceus*); Wiggins & Porter (1971: 679, fig. 186, as *H. tiliaceus*).

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** CHIAPAS: Las Garzas, Acapetagua, Matuda 2730 (LL, MEXU).—JALISCO: N of Puerto Vallarta, Dieterle 3115 (MICH); Mpio. La Huerta, beach near Rancho Cuixmala, 19°21'N, 104°58'W, Rothschild & Upson 387 (TEX, UCR).—MICHOACÁN/GUERRERO: embouchure du Río Balsas, Langlassé 148 (US).—NAYARIT: Mpio. Bahía de Banderas, duna costera entre el Hotel Villa Varadero y la desembocadura del río, Cházaro & Montes 6332 (TEX-2); Tres Marias Islds., María Magdalena Isld., seashore, Maltby 172 (US); Río La Tovar, SE of San Blas, 21°32'N, 105°14'30"W, Van Devender 94-38 (ARIZ, TEX); Socorro Island, NE slope above cove 2.5 km E of Cabo Henslow, 18°49'N, 110°59.5'W, Moran 25547 (US); San Blas, river areas by estuaries, Wilson 11081 (TEX).—QUINTANA ROO: 3 km al S de Puerto Morelos, Cabrera 11508 (MEXU, TEX).—TAMAULIPAS: Mpio. Aldama, on coast 10-15 mi S of Barra de Tordo, Fryxell 3712 (CHAPA, ENCB, GB, MEXU, MICH, NY, TEX, US); coastal dunes near Moron, LeSueur 279 (TEX).—VERACRUZ: Tecolutla, 24 Jun 1947, Johnston s.n. (TEX); Mpio. Tuxpan, ca. 6 km al N del Río Tuxpan, sobre la playa, Koch 7845 (CHAPA, TEX); Playa Paraíso, a 30 km al NE de Ciudad Cardel, Novelo 372

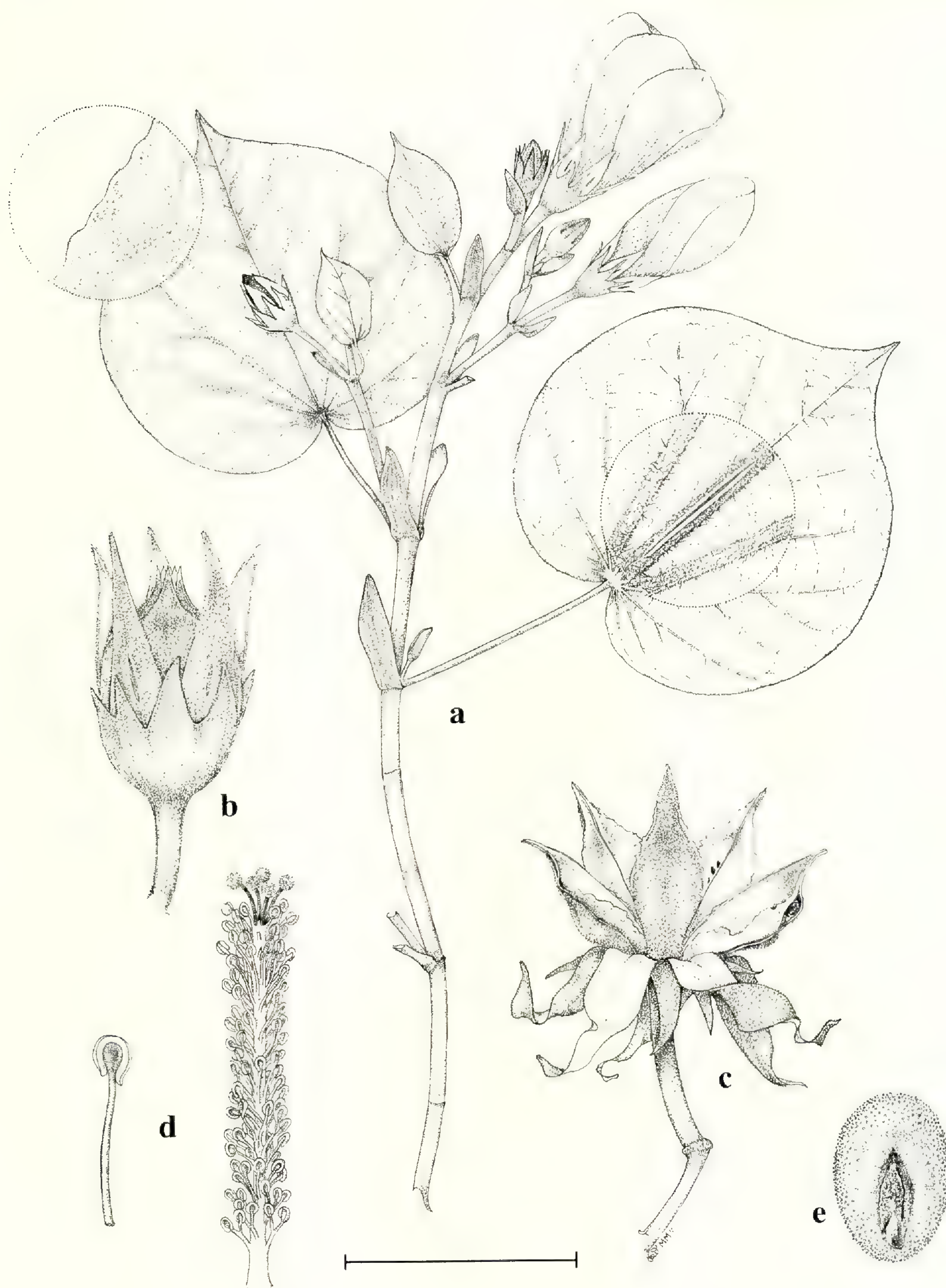


FIG. 5. *Talipariti tiliaceum* var. *pernambucense*. a. Flowering branch, with margin of leaf and nectary on abaxial midrib enlarged. b. Immature fruit showing involucre and calyx lobes with abaxial nectaries. c. Fruit after dehiscence. d. Androecium and stigmas, and one stamen. e. Seed. Scale: a, bar = 6 cm for habit, 6 mm for leaf margin, 1.2 cm for abaxial nectary. b, c, bar = 2 cm. d, bar = 2 cm for whole androecium, 5 mm for stamen. e, bar = 6 mm. Drawn for *Flora Novo-Galiciana* by Karin Douthit. (Based on: a–c, Dieterle 3115; d, Lott 2555; e, Stewart & Percival 84-1.)

(MEXU, TEX); Estero de la Silveña cerca de Tecolutla, Rzedowski 19983 (ENCB, TEX). **Belize.** Northern Highway, 4 mi NW from Belize, Wiley 146 (LL). **Honduras.** COLÓN: Río Guaimoreto near opening of Laguna Guaimoreto, 15°57'30"N, 85°54'30"W, Saunders 268 (TEX). **Nicaragua.** RIVAS: Playa El Coco, 11°09'N, 85°47'W, Stevens 3795 (MO, TEX). **Costa Rica.** GUANACASTE: Parque Nacional

Santa Rosa, road to Estero Real, *Huft et al.* 2086 (LL, MO).—PUNTARENAS: Parque Nacional Corcovado, Sirena, 08°27–30'N, 83°33–38'W, *Kernan* 3 (MO, TEX). **Panama.** CHIRIQUÍ: Burica Peninsula, Guanábano, 2–4 km S of the center of Puerto Armuelles, *Busey* 489 (LL, MO).—COCLÉ: Sta. Clara Beach, *D'Arcy & Croat* 4090 (MO, TEX).—PANAMÁ: Playa Venado, 08°54'N, 79°35'W, *Knapp* 1916 (LL, MO).

Grand Cayman. Western District: several miles N of Georgetown, *Crosby et al.* 15 (DUKE, LL). **Dominican Republic.** LA ALTAGRACÍA: Bahía de Maimón, 18°51'N, 68°38'W, *Zanoni & Jiménez* 44510 (NY, TEX).—SANTO DOMINGO: edge of Río Jania, *Ekman* 12489 (LL). **Jamaica.** St. Ann Parish: mouth of the Pear Tree Bottom River, 1.5 mi W of Runaway Bay, *Proctor* 23908 (LL); St. Catherine Parish, near shore of Manatee Bay, *Proctor* 29159 (LL); Hanover Parish: Rutland Point, S of Bloody Bay, *Proctor* 32482 (LL). **Dominica.** St. John Parish, Indian River, S side of Portsmouth, *Hill* 22026 (TEX).

Colombia. CHOCÓ: Nuqui-Pangui, Playa la Olimpica, 05°19'N, 77°17'W, *Gómez et al.* 398A (HUA, LL).—VALLE: costa del Pacífico, Isla del Guayabal, en la desembocadura del Río Cajambre, *Cuatre-casas* 16175 (US). **Ecuador.** EL ORO: Puerto Juli, *Albert de Escobar* 980a (TEX); Arch. Jambelí, Isla de Amor, *Cornejo & Bonifaz* 5986 (TEX).—GALÁPAGOS: Cocos Island, *Stewart* 302 (US).—MANABÍ: Las Tunas, *Bonifaz & Cornejo* 3521A (TEX). **Guyana.** Essequibo Isl.-W. Demerara, 06°50'N, 58°28'W, *Henkel et al.* 2667 (TEX, US). **Surinam.** Distr. Commewijne, *Hekking* 821 (LL). **Brazil.** BAHIA: Canavieiras, *Lanna* 735 & *Castellanos* 25487 (LL).—RIO DE JANEIRO: Rio de Janeiro, *Glaziou* 18887 (US). **Argentina.** CORRIENTES: Facultad de Ciencias Agrarias, cultivado (procede de Brasil, SP, Caraguatatuba, manglar), *Krapovickas* 32969 (CTES, TEX-2).

Don (1831) and Johnston (1949) attributed the basionym *Hibiscus pernambucensis* to Bertoloni (Exc. Re Herb. 13. 1820), but Hochreutiner (1900: 64) provides evidence that Bertoloni's use of the name was based on that of Arruda. Nomenclatural problems relating to the names *H. pernambucensis* and *H. abutiloides* Willdenow (see below under Doubtful and Excluded Names) are more fully discussed by Fryxell in Howard (1989: 226).

22. *Talipariti tortuosum* (Roxburgh) Fryxell, comb. nov. *Hibiscus tortuosus* Roxburgh, Fl. Ind. 3: 192. 1832, non *Hibiscus tortuosus* Wallich ex Prain, 1903. *Pariti tortuosum* (Roxburgh) J. O. Voigt, Hort. Suburb. Calcutt. 120. 1845. *Hibiscus tiliaceus* var. *tortuosus* (Roxburgh) Masters in Hooker, Fl. Brit. Ind. 1: 343. 1872.—TYPE: INDIA. *Wallich* 1913.B (holotype: K-W).

Bushy trees with numerous, widely spreading, crooked branches, the twigs sparsely pubescent to glabrescent, purplish (?). Leaf blades broadly rotund-cordate, ca. 10 cm long, 10 cm wide, minutely crenulate, acuminate, minutely and obscurely pubescent above, densely hoary-pubescent beneath, the foliar nectaries absent; petioles 2–4 cm long, densely stellate pubescent especially distally; stipules obliquely oblong to ovate-lanceolate, to 2.5 cm long, ca. 1 cm wide, densely pubescent, deciduous. Peduncles terminal, 2–3-flowered; the pedicels axillary, densely stellate-pubescent, the flowers drooping [ex descr.]; involucellar bracts 7–10, distinct, lanceolate, equalling the calyx, densely pubescent; calyx 5-parted, densely pubescent; petals 7 cm long, bright yellow with a crimson center, campanulate; styles 5, the stigmas dark red. Capsule equaling the calyx, ovoid, acute, densely stellate-pubescent, 5-carpelled (but seemingly 10-celled because of double partition); seeds 2–4 per carpel, obovate-reniform. [This description is taken from Roxburgh's description and from the specimen cited below.]

SPECIMEN EXAMINED. **India.** Calcutta Botanic Garden, 3 Jul 1883, *Brace s.n.* (NY).

Although poorly known, *T. tortuosum* stands out as one of the yellow-flowered species with distinct involucellar bracts, along with *T. pseudotiliaceum*, which differs in having fewer, broader involucellar bracts (Fig. 2n).

Roxburgh (1832) and Masters in Hooker (1872) cite Rheede's plate 30 under *H. tortuosus* and *H. tiliaceus* var. *tortuosus*, respectively. The plate, however, does not have the long involucre that Roxburgh uses (among other characters) to distinguish *H. tortuosus* from *H. tiliaceus*.

DOUBTFUL AND EXCLUDED NAMES

Hibiscus abutiloides Willdenow, Enum. Pl. Hort. Berol. 736. 1809. *Paritium abutiloides* (Willdenow) G. Don, Gen. hist. 1: 485. 1831. *Paritium elatum* var. *abutiloides* (Willdenow) Grisebach, Fl. Brit. W. Ind. Islds. 87. 1859. *Hibiscus tiliaceus* var. *abutiloides* (Willdenow) Hochreutiner, Nova Guinea 14: 163. 1914.—TYPE: unknown.—The type specimen apparently is not extant (Borssum Waalkes 1966; Hiepko 1972), and the original description is too general to allow for determination of the species to which this name applies.

Hibiscus guineensis DC., Prodr. 1: 454. 1824. *Paritium guineense* (DC.) G. Don, Gen. hist. 1: 485. 1831.—TYPE: "Côte de Quoja," 1820, *Baclé s.n.* (holotype: G-DC!).—Because the type specimen is sterile, the name cannot be assigned with certainty; perhaps it is a synonym of *Talipariti tiliaceum*.

Hibiscus tiliaceus var. *glaber* ["*glabra*"] Matsumura ex Hattori, J. Coll. Sci. Imp. Univ. Tokyo 23(10): 30. 1910, nomen nudum.

Hibiscus tiliaefolius in Salisbury, Prodr. Stirp. 383. 1796.—Error for *Hibiscus tiliaceus* L.

Hibiscus tortuosus Roxburgh ex Wallich, Numer. List ["Wallich's Catalogue"] 1913. 1829, nomen nudum.

Pariti tiliaefolium in Nakai, Fl. Sylvat. Koreana 21: 101. 1936.—Nakai's combination was based on Salisbury's (Prodr. Stirp. 383. 1796.) erroneous citation of "*Hibiscus tiliaefolius*" for *Hibiscus tiliaceus* L.

Paritium gangeticum G. Don = *Thespesia lampas* (Cavanilles) Dalzell & Gibson.

Paritium paoui Vieillard, Ann. Sci. Nat. Bot., sér. 4, 16: 75. 1862.—TYPE: unknown.—The description is not sufficient to assign the name with certainty.

Paritium purpurascens Seemann, Bonplandia 9: 254. 1861, nomen nudum.

Paritium quinquelobum Hooker f. = *Hibiscus sterculiaefolius* (Guillemin & Perrottet) Steudel.

Paritium sterculiaefolium Guillemin & Perrottet = *Hibiscus sterculiaefolius* (Guillemin & Perrottet) Steudel.

Paritium virgatum Guillemin & Perrottet = *Hibiscus perrottetii* Steudel, non *Hibiscus virgatus* Blume.

Paritium wrayae (Lindley) Walpers = *Alyogyne huegelii* (Endlicher) Fryxell.

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THE BOTANICAL ACTIVITIES AND CORRESPONDENCE OF ROBERT PETER, M.D. (1805–1894)

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ABSTRACT. An account of the botanical interests of Robert Peter (1805–1894) in Pittsburgh, Pennsylvania (1829–1833), and Lexington, Kentucky (1833–1835), is presented. In addition to a biographical sketch, Peter's contact with other botanists, most importantly Amos Eaton and Charles Wilkins Short, his collecting activities, and his manuscript "Catalogue of plants about Pittsburg Pa. 1828–1833; catalogue of plants of Kentucky 1833 to 1835" are described. Three appendices list in detail Peter's collecting localities, the plants collected by Peter, and a list of botanical publications available to him. A list of references cites all sources consulted. The first set of Peter's plants was part of the Herbarium of the University of Kentucky, but was destroyed by fire in 1948. The Herbarium of the University of Michigan owns the only sizeable Peter collection remaining: 279 specimens, the majority formerly a part of Douglass Houghton's herbarium; additional herbaria holding Peter specimens are also listed. Illustrations include a portrait of Peter, samples of his handwriting, and samples of herbarium labels.

INTRODUCTION

In the Herbarium of the University of Michigan (MICH) at Ann Arbor are 279 specimens¹ collected by Robert Peter, M.D., mostly in the vicinity of Lexington, Kentucky, during the years 1833–1835. Their significance lies in their age, their good quality and preservation, and in the fact that the original set of Peter's plants at the Herbarium of the University of Kentucky (KY) was destroyed by fire in 1948.²

By means of correspondence with a number of herbaria and historical societies; by work done in the archives of Transylvania University³ and the University of Kentucky, both located in Lexington, and of the Filson Club, Louisville; by reading old letters; by consulting the records of a family that "never threw anything away"; and by study of Peter's own manuscript "Catalogue of the Plants about Pittsburg and of Kentucky," and of the labels of the specimens themselves, it was possible to compile a picture of Peter's botanical activities. Particularly helpful were some preliminary research materials furnished by Dr. Ronald Stuckey of The Ohio State University.

The specimens at MICH bear, with few exceptions, a label in Peter's handwriting, with the stamp, "ROBERT PETER, M.D., LEXINGTON, KY." Most also are stamped "DOUGLASS HOUGHTON," indicating that they had once formed a part of Houghton's collections (Fig. 1). The link between the two men was not known, and posed one of the intriguing questions to be answered in this study.

Because of John Dean Wright's excellent thesis, *Robert Peter and Early Science in Kentucky* (1955), little could be added to Peter's biography, and only a summary is given here⁴; however, Peter's botanical activities, of relatively short duration, are mentioned only cursorily by Wright.

Robert Peter (Fig. 2) was representative of his time, the flowering of the naturalists' period in America, the century and more from roughly 1725 to 1840 or

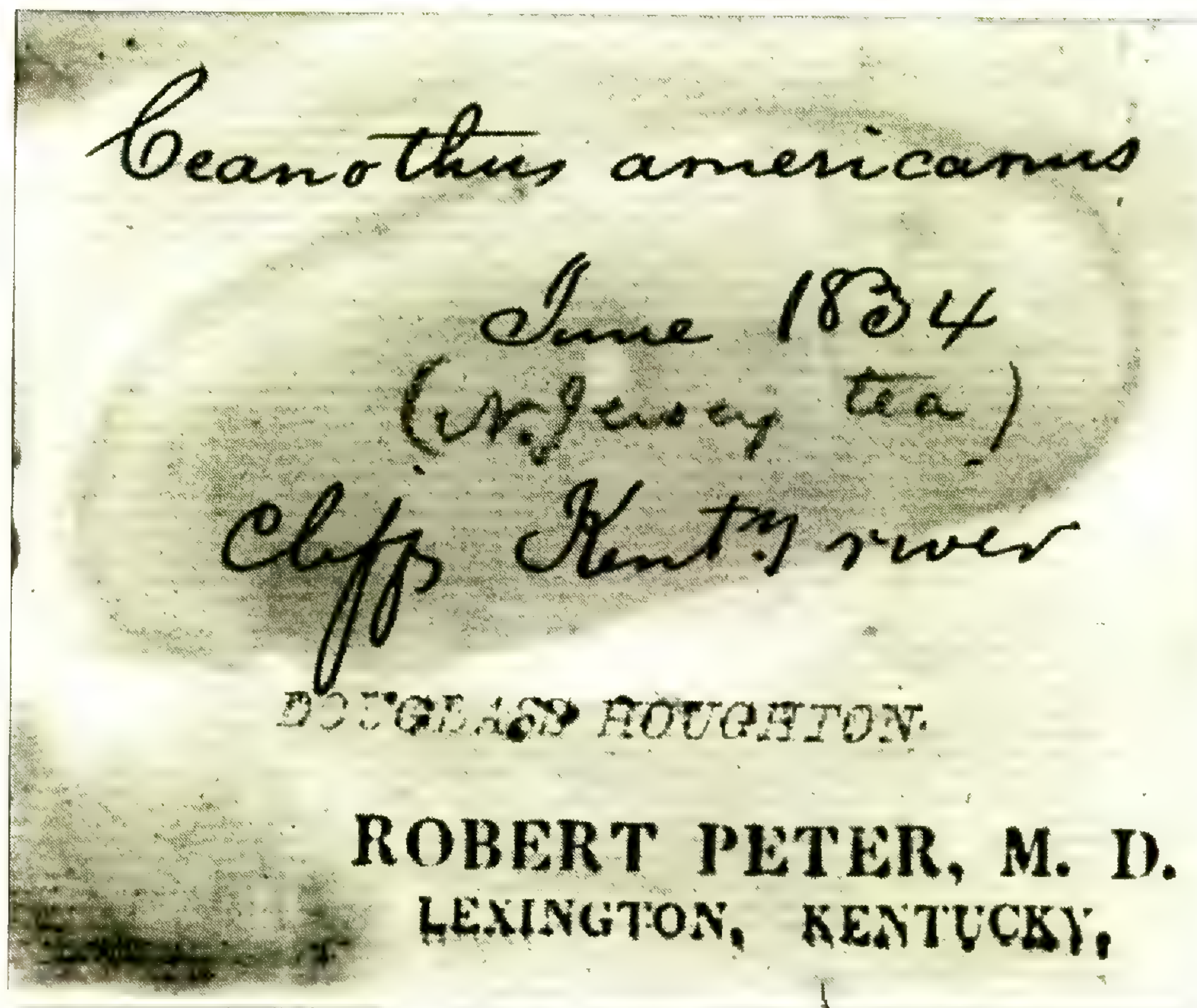


FIG. 1. Label from a Peter specimen of *Ceanothus americanus* L. at MICH, stamped with the names of both Robert Peter and Douglass Houghton.

1850, which reached its climax in the 1830–1840 period. The exploration of the new wilderness, discovery of a wealth of new species of flora and fauna, the active exchanges of specimens within America and between America and Europe produced an intellectual excitement and enthusiasm.⁵

Meisel⁶ lists five agencies most effective in the promotion and diffusion of scientific knowledge during the Pioneer Century of American Natural History: (1) scientific societies; (2) scientific journals; (3) state geological and natural history surveys; (4) natural history museums and botanic gardens; and (5) federal exploring expeditions and surveys. Of these five agencies, Robert Peter was actively involved in three and, to an extent, a fourth.

Peter procured and read the best books, worked meticulously, took advantage of the educational opportunities that came his way, and shared his knowledge with others. Because of the excellence of his work, he left behind him a relatively small yet significant contribution to botanical knowledge.

A review of Peter's early life shows that he was born in Launceston, Cornwall, England, on January 21, 1805, one of seven children of Robert and Johanna (Dawe) Peter. When he was twelve, the family emigrated to America, settling in Pittsburgh, Pennsylvania, where the young Robert became the assistant of Charles Avery, wholesale druggist.

He read widely on scientific subjects and became an active participant in local scientific societies. He became a naturalized citizen of the United States in 1828. During the summer of 1828, he attended, by invitation, a twelve-week session at Rensselaer School (now Rensselaer Polytechnic Institute) at Troy, New York. Upon returning to Pittsburgh, he lectured on scientific subjects at the Western University of Pennsylvania and also at the Mechanics' Institute in Pittsburgh. In 1829, he set up his own drug store.

In 1832, he was invited to give a course of lectures in chemistry, during the



FIG. 2. Robert Peter, M.D. (1805–1894), ca. 1840. (Photo courtesy of the University of Kentucky Libraries.)

summer, at Peers Eclectic Institute in Lexington, Kentucky. That fall he became, by private arrangement, chemical assistant to Dr. Lunsford Pitts Yandell at the Medical Department of Transylvania University. His pay consisted of room and board, \$300, and tickets to attend the lectures. He received the degree of M.D. in 1834, but practiced medicine only three years, preferring to devote his time to teaching and research. During the first two years at Lexington, he actively botanized with Charles W. Short.

In October, 1835, he married Frances Paca Dallam, daughter of an old and

distinguished family. They were to have eleven children.

After 1835, he concentrated his attention on his chemical and mineralogical studies and teaching. In 1839, he visited Europe to purchase books and chemical apparatus for Transylvania University and, while there, attended lectures in Paris and London.

He was associated with the founding of the Kentucky School of Medicine at Louisville in 1850, and commuted to give lectures there for three years, after which he returned to the Medical School of Lexington.

During the Civil War, he served as acting assistant surgeon in charge of the United States general hospital in Lexington.

In 1865, Peter was appointed professor of chemistry and experimental natural philosophy in Kentucky University, which merged with Transylvania University and the Kentucky Agricultural and Mechanical College to become today's University of Kentucky. He remained there until 1887.

A memorial to the Kentucky legislature, which Dr. Peter prepared, resulted in the initiation of the Kentucky Geological Survey of 1854. As chemist of the survey, he made a valuable contribution to the knowledge of the minerals and soils of the state. He was the first to call attention to the fact that the productivity of the bluegrass soils of Kentucky is due to their phosphorus content and to report on the phosphatic limestone that underlies much of the bluegrass country. He was also chemist for the Arkansas and Indiana surveys directed by David Dale Owen.⁷

Throughout his life, he was a ready and prolific writer on a number of topics and corresponded with many of the scientists of his time. His interests were broad, encompassing conchology, entomology, botany, chemistry, mineralogy, medicine, horticulture, and archeology. "He had an ear always alert for new ideas, a trait strikingly displayed even in old age, and would sweep cheerfully aside his most cherished theories when they were shaded by dawning scientific facts."⁸

Peter died on April 26, 1894, at the age of eighty-nine.

PITTSBURGH (1829–1833)

Going back now, after this brief overview of Peter's life, to examine more closely his botanical work, we may look first at the Pittsburgh years, from which only nine specimens survive at MICH.

Doubtless stimulated by his contacts with the various scientific societies and by his own reading, he began the methodical collection of plant specimens. A brown leather-bound volume found in the University of Kentucky Archives, in his own handwriting, begins thus⁹: "Memo. Bot. Society (in Pittsburg [sic], Pa.) instituted January 9th 1828. Catalogue of Plants about Pittsburg Pa. 1828–33 up to No. 565. Catalogue of Plants of Kentucky 1833 to 1835 up to No. 935."

There follows an index to species included, added to over the years. Although he sometimes recorded the collection of a species more than once, he entered it in the index only the first time. The first Pittsburgh entries, beginning in March, 1828, found him looking at cryptogams. He used a numerical entry giving Linnaean analysis, the first number, sometimes superscripted "C," indicating class, and "O," order, with notes on habitat, unusual for his time, followed often by a careful description of the plant.

- No. 1 *Asplenium rhizophyllum* (Eaton) (Walking leaf & leaf rooting spleenworts) 22.1
 March 9th 1828 On rock in shady vallies near streams etc.
 No. 2 *Hydnum concrescens*? 22.6 on decaying trunks of trees March 9, 1828.
 No. 3 *Usnea florida* 22.5 Tree moss on trees March 17, 1828.
 No. 4 *Dedalea Quercina* 22.6 On trunks of oaks etc. March 17, 1828.
 No. 5 *Boletus Fomentarius* on trunks March 17, 1828.

Then item No. 6 finds him collecting that true harbinger of spring, the skunk cabbage, thus recorded in a precise manner.

No. 6 *Ictodes Foetida* 4.1 (Skunk cabbage *Foetia hellebore*) March 26, 1828. (*Synon.* *Pothosfetida* (Michaux) *Dracontium fetida* (Lin.) *Symplocarpus* (Salisbury). Localities in damp low meadows in vallies etc. The spathe appears and decays before the leaves are developed. Consequently if they could be dispensed with in the description of the plant in the manual it might tend to simplify.

It is probable that Peter's reference was *Eaton's Manual*. He continues on, the recorded plants recalling the beginning spring collection lists of every taxonomist in the northeastern and eastern United States.

No. 10 *Pulmonaria Virginica* April 7, 1828 5.1 In damp, shady, sandy places—Leaves ovate obtuse, erect, flowers terminal and axillary, pink becoming blue, nodding, calyx 1/3 the length of the corolla in the fully expanded flower, stem juicy.

So on through the names: *Pyrus coronaria*, *Hydrophyllum virginicum*, *Veronica anagallis*, *Achillea millefolium*, *Rumex crispus*, *Monarda ciliata*, *Scutellaria lateriflora*, *Inula helenium*—one sees the summer unfolding, through his numbers 1 to 197. Then, following his entry of July 21, 1828, "*Mollugo verticillata* 3.3—white Carpet weed, sand-damp—," there was an abrupt cessation until March, 1829. The interruption was due to the term at Rensselaer.

The Fall Term, as it was officially called, started on July 17 and ended on October 29, 1828. Since the term consisted of a series of five three-week 'sub-terms,' it is possible Peter did not start classes until August 7.¹⁰ In the 1828 Rensselaer *Catalogue*, Peter was listed on page seven among the undergraduates present at the school as "Robert Peter, Jr., Pittsburgh, Penn. Lecturer on the Experimental and Demonstrative Sciences. Druggist,"¹¹ and in a later record as, "Non-graduate, Peter, Robert, Jr. . . . 1826 [sic.]"¹²

At Rensselaer School, that late summer and fall of 1828, Peter came under the influence of Amos Eaton, eminent botanist and geologist.

Eaton, fifty-two years old when Peter arrived at Troy, had found at Rensselaer's school the opportunity to experiment with a new method of teaching the natural sciences. This was to allow the student to deliver lectures and conduct experiments. When the student had to explain and illustrate to others the material he was studying, Eaton was convinced that the student would learn faster and more thoroughly.¹³

This emphasis on practical application left a lasting impression on Peter, who later employed the same method in teaching the natural sciences.¹⁴

The original notes made by Peter on the lectures of Amos Eaton exist in the archives of Transylvania University, covering lectures on civil engineering, geology, an introduction to the sciences, mensuration, mineralogy, natural philosophy, and practical surveying. The certificate furnished Peter did cover chemistry, botany, and zoology also, which may indicate some lecture notes are missing or that Peter was examined on some subjects not covered by Eaton's lectures.¹⁵

Robert Peter was not a graduate but was given a certified statement of the results of his study in Rensselaer and a "personal certificate" signed by Amos Eaton:

We having been duly appointed examiners of Rensselaer School by the Hon. Stephen Van Rensselaer for the fall term of 1828, certify that Mr. Robert Peter, Jun. a student of said school, who was presented to us for examination, by the acting members of the faculty, was found to have a knowledge of Chemistry, Natural Philosophy, Mineralogy, Botany, Zoology, and Geology in a Super-medium degree.

No student was presented for the Rensselaer degree, both the faculty and students deeming it necessary that each individual should go through an experimental review before receiving it.

To John Chester DD

Mark Tucker Chairman
 Marcus Smith
 Benj. F. Joslin Examiners

We certify that the above is a true copy from the record of the school, and that Mr. Peter possesses the merit above ascribed to him.

Rensselaer School
 October 29th, 1828

Amos Eaton
 Senior Professor
 C. L. Holley
 1st V. P.

With pleasure I add my *personal* certificate in addition to the within official one that Mr. Peter is competent to teach Chemistry, Experimental Philosophy, Botany, Mineralogy, Geology, and the elementary principles of Zoology. To this I pledge myself personally from my knowledge of Mr. Peter.

Rensselaer School, Troy, Oct. 30th, 1828 Amos Eaton¹⁶

A receipt made out to Robert Peter, dated October 27, 1828, and signed by Amos Eaton, Agent for Rensselaer School, acknowledges Peter's payment "To board 12 weeks, \$21, and textbooks (Phil. Chem. Min. Zo) \$3," a total of \$24.¹⁷

Proficiency in such a variety of subjects, gained in only a twelve-week span of time, seems unlikely, until one reads in the 1828 Rensselaer Exercises that the student was expected to arise at sunrise, and twenty-five minutes later to "appear in the reading-room for examination in the subjects of the preceding day's exercises." Following lectures from nine o'clock to one o'clock, given by the professor, the daily assistant, two sub-assistants, and the students, dinner was at one o'clock. After this, students went to "their respective departments to prepare for the experiments and demonstrations of the next day's lecture," all preparations "usually completed by four o'clock." Students then repaired to the reading-room, "at the ringing of the bell, to receive directions for the afternoon amusements," which consisted of visits "to work-shops, factories, etc. for the purpose of applying the principles of mechanical philosophy and chemistry to the various operations of artists, or to the field to collect plants and to examine facts illustrative of the philosophy of vegetation." Or, if it were the winter term, they might study the use of "the sextant, compass, goniometer, blowpipe, telescope. . . making and using ice lenses and prisms; drawing maps; and dissecting animals. . . ." Every other Saturday, students were at liberty after the morning examination. The other Saturdays, also Friday and Saturday evenings, were devoted to parliamentary exercises. As no school exercises preceded the morning examinations of Sabbaths and Mondays, these examinations were confined to distinct subjects, Sunday concerned with Ecclesiastical History, and Monday with Philosophy of the Human Mind, and of Moral Philosophy.¹⁸

It is probable also that Peter was examined on subjects in which he was self-taught. A Pittsburgh newspaper article of 1837, quoted in the *Lexington Intelligencer*, said:

Dr. Peter resided in this city [Pittsburgh] from his early childhood, and grew up with a reputation not merely good but remarkable for uprightness and unflinching integrity. In his boyhood he had few associates but his books, the time generally employed by others in idle amusements, was by him devoted to the study of sciences; hence before he had attained his majority, he was universally referred to for scientific information, and classed among our literati, and for several years previous to his removal to Lexington, his acquaintance and correspondence was solicited by men of science in the east as in the west.¹⁹

The personal contacts made at Rensselaer were to be important in Peter's life. "Letters scattered through Peter's correspondence from former acquaintances at the Rensselaer school indicate that [he] had made fast friends with several students."²⁰ Among these acquaintances was Hezekiah Hulbert Eaton, son of Amos.

Four years younger than Peter, Hezekiah had entered Rensselaer in the fall of 1824, at the age of fifteen, and graduated in 1826. Having lectured at several institutions, he preceded Peter to Lexington in the fall of 1829. He also first taught at Peers Eclectic Institute, then became assistant professor of chemistry at Transylvania University,²¹ and became associated with Charles Wilkins Short in botanical activities. His untimely death from consumption in August, 1832, left a vacancy which Peter was invited to fill.²²

I found no evidence among the Peter papers that Peter and Douglass Houghton had any acquaintance at this time, although such acquaintance seems likely. Houghton received his B.A. from Rensselaer in 1829, a year later than Peter.²³

Upon his return from Rensselaer to Pittsburgh, Peter resumed his duties at Charles Avery's drug store, but left within a year to establish one of his own, which "provided him with the necessary income on which to live, but did not hamper his activities in scientific fields."²⁴ He lectured before various groups on scientific topics, including chemistry, in the Western University of Pennsylvania.²⁵

Caught up in the intellectual ferment of the time, he participated in correspondence with other scientists and in the exchange of geological, entomological, conchological, and botanical specimens. He "was curious about all aspects of these various fields, and devoted a good deal of time to reading the best books on the subjects and in exploring the regions about Pittsburgh in search of specimens. He was acquainted with the books of that strange and gifted natural scientist, Constantine Rafinesque, and had ordered copies of Cuvier from a bookdealer in Philadelphia."²⁶

Peter was active in forming a scientific society in Pittsburgh. According to Meisel,²⁷ a Pittsburgh Chemical and Physical Society had been organized previously on October 29, 1813, but disbanded in December, 1814. Members had made a mineralogical collection and a small museum. In letters to J. R. Lambdin of Philadelphia, Peter described the new society's beginnings.

January 23, 1828

In giving you this Epitome of the changes and improvements going on in our city, it would be worse than treason to omit mentioning the *Pittsburg Botanical Society*, which has been organized—a little society with a large name. It has at present 9 members, among whom (of course) your most obedient is to be classed. Its object is the improvement of ourselves in the science, and the examination of the flora of the vicinity of Pittsburg. We are all waiting most patiently for Spring when

"Lightly we'll ramble oe'r meadow and mount
All eager to gather the plants in the way."

Excuse the quotation.²⁸

Feby 9, 1829

I received your kind letter dated Feby 2nd on yesterday morning together with the book which you were so kind as to purchase for me, for which receive my thanks. It is just the work that I wanted and I am very much pleased with it.

I would have answered yours yesterday but as our society was not organized we could not obtain a meeting untill this evening, therefore I determined to wait untill I could return some answer to your proposition to the society. I have just returned from our first meeting, it was held at the academy. Dr. Bruce was in the chair. after resolving that the name of the society should be the Pittsburg. Ph. So. and appointing committees to draft a constitution and obtain new members your business was brought on the floor. As there were not more than 8 members present the consideration of the subject was deferred untill a more full meeting, however, all the members present expressed their opinions, the sum of them is as follows. they do not like to *advance* money without knowing what the nature of the apparatus will be which they are to receive in return, they would like to purchase their own apparatus, as the fund in their hands is small, so that they could get what was most essentially necessary for a commencement. One member (who was not at the meeting) went so far as to say that he would withdraw his name should the society agree to the proposal. Notwithstanding all this they entertain favourable sentiments both toward you and your undertaking and I do not doubt but that when you are established each member of the society will purchase from you a season ticket. Dr. McClunge, one in particular said that if you would agree to it he would advance the price of one to you, and endeavour to get others to do so also. I would heartily join with him. The general opinion of the society is that we are too poor.

[Page 2] As regards your proposal to myself, I answer that such an undertaking would be in exact accordance to my taste *but* my engagements with Mr. Avery are such as to render impossible for me in strict honour to leave him. nevertheless as I told you before whatever my feeble efforts can effect shall be done to the advancement of the undertaking. I will not pretend to offer you what I shall not be able to give, pecuniary assistance, the smallness of my salary will preclude that, but whatever assistance I can give you in the collection arrangement and preservation of subjects for your museum is at your service. You expressed a desire to know the names of the members of our Society. I send them to you. another meeting in march.

As for our Botanical Society, we have of course provisions for female members, they are to be completely honorary, but we do not wish to have any proposed until Spring as the subjects of discussion will then be more interesting and we shall be better fitted to receive them.

I am of opinion, and I believe that it is pretty generally the opinion of all the members that some kind of a union should be formed between the Museum and the Phil So and that it would be to the advantage of both the idea of advancing money which is so much wanted in the commencement is what they stopped at.

Our commencement is a very flattering one and I dare say it will kick up some dust, as the minutes of the meeting are to be published.

Dr. Bruce suggested the name.²⁹

Amos Eaton wrote from Troy to his former pupil on March 9, 1829.

My dear Sir,

By the Hesperis, I perceive that you are engaged in a good cause [?]

I have every thing to do—you know I rely upon Dr. Wright for all nice [?] guesses etc. His death has thrown a larger burden upon me, than you might suppose. Hezekiah has taken his place, and is improving rapidly. The 5th Ed of our Manual, including all plants north of the Gulf of Mexico is now rapidly advancing. But I was employed full three months in preparing the [—?—]. I did not expect such a task until I had thoroughly examined the sources from which I was derive [?] materials. Between 20 and 30 volumes I referred to from 10 to 20 times every day. Now the genera are printed and species as far as Carex. Hezekiah and G. W. Aikin [?] devote their whole time to the work. It will probably be in the New York bookstores about the 20th of April a little sooner if possible.³⁰

Eaton concluded with some remarks about geological specimens and a planned trip to the south part of Pennsylvania.

Peter's reputation was growing. A letter from Lewis David von Schweinitz to John Torrey, dated Bethlehem [Pennsylvania], 8th September, 1831, said:

At Economy³¹—Rapps famous settlement near Pittsburg—I was much pleased to look over the Herbar[ium] of old Dr. Muller—& of the printer Schnabel & so got some interesting specimens from Wabash. But this examination again convinced me of the very peculiar plants the western country contains—especially when grasses & the Synginesiaces autumnal plants are not included—as was the case in these herbariums. All my enquiries concerning a Botanist in Pittsburg had remained unsuccessful but behold—while poring over the Economy herbarium—I experienced an interesting instance of the proverb, Where the carcass is, the eagles gather, one of the casual visitors from Pittsburg was by this means induced to make himself known to me as a lover of the science & afforded me a very interesting opportunity next day to look over his not inconsiderable collection of plants from the vicinity of Pittsburg.³²

In his journal,³³ von Schweinitz again referred to this 1831 visit, and to the museum at Economy:

The herbarium gave me great pleasure and yielded me many plants, as well as the acquaintance—bearing similar good fruit—with a Pittsburg apothecary who also happened to be there and introducing himself as a botanist, invited me to his house.

Ten specimens of this “similar good fruit,” bearing Peter’s labels, remain today in the Schweinitz collection at the Philadelphia Academy of Sciences.³⁴

Other evidence of Peter’s botanical work at Pittsburgh is contained in letters written to him. Dr. B. Shnabel wrote to him from Economy on June 8, 1828:

Dear Sir,

The letter addressed the P. Botanical Society contains a list of the plants which I have collected since I have seen you last. I thought most proper to send it before I would send any specimens, as I might send shuch [sic] as would not be interesting to you, and omitt those which you would licke to have.—If you will please to let me know which of them you wish to see I will send them with the first oportunity.—If it would not be too much trouble, I should be very glad to see a list of those which you collected and are not contained in my list.

The medical Flora of Rafinesque, which you lent me, I would thankfully keep a little while longer if you have no objection, as I have not had the time since to peruse it to my satisfaction. I shall probably want to buy the worck after the 2d vol is publish’d.—If there would be a chance of getting Etons Manual I wish you would let me know, and also the price of it.—The Hesperus I have regularly received till now and have been well pleased with the contents of it, I am therefore very much indebted to you for your kindness, and the first opertunity to reward it, will give me much pleasure.

Your sincere Friend etc.

B. Shnabel³⁵

Elias Durand of Philadelphia corresponded with Peter several times, regarding exchanges of specimens and the procurement of books. Durand, a French botanist, had been formerly a member of the medical corps of Napoleon’s Army³⁶. He was himself a collector of scientific specimens as well as an intermediary among other naturalists.

Philadelphia
March 8th 1829
Dear Sir.

I have just received a collection of plants from western and meridional parts of France, and of the Pyrenees. It amounts to about 500 or 600 specimens, all entire, well preserved, and belonging only to the old Hemisphere, I mean that none of them are common to Europe and this continent. If you are disposed to exchange them with plants of the Ohio, you are wellcome. I wish yours to be peculiar to your regions, and, as much as possible, to be accompanied, if not with the name at least with the locality and the time of their flowering.

The learned friend and correspondent for whom these plants are, wishes very much to have a collection of terrestrial and fluviatile shells of America. If you can procure him those of your country, you may rely on an ample return from him. Mr. Peale of our city had furnished me with some of the neighbourhood of Philadelphia. I have now for him a complete collection of the same from France. Every article in natural history you may have to exchange for European, you may send them to me, and I give you my word that Justice and liberality will preside to the return.

Believe me, Dear sir, your obedient Servant
E. Durand

[On the same sheet, the following:]

Dear Friend

I received your kind letter dated 23 Feb. and aprove very much of your plan of correspondence. I have inquired of the articles you asked me. none of the books are to [be] found in the city a[t] present. I got the letter in time to go to Landreth and tell him of the plants. he has not sent them yet on account of the cold wether but he will as so[o]n as it is milder. Answer Mr. Durands letter as soon as possible as he is waiting for an answer. My respects to all the family.

I remain yours etc.
E. G. Dubarry Jr.
excuse bad writing. I am in a great hurry.³⁷

On April 2, 1829, Durand wrote again:

Edward will forward you a box containing 140 specimens of gramineus and 130 other plants, all from the southern and western parts of France. Be so good as to send me in exchange as many subjects peculiar to your region as you can. The balance will be _[?_] up to you. Any thing (except minerals) belonging to natural history will be received by my friend and correspondent in France. The objects he seems principally desirous of receiving are fluviatile and terrestrial shells, plants, and Lepidopteres and Coleopteres. There is no *Species* of Latreille to be found either in New York or Philadelphia. There is one by Conte Dejean (in french)—which is more recent and considered as superior to Latreille's. He describes only the insects of his collection, the greatest in Europe. In that respect he had the chance of giving an accurate description of each individual by comparing every one of them himself whilst in similar works, many descriptions are given according to others, and an individual is often described under two or three different names. If you are familiar with the french languages, I advise you to buy this work in preference to Latreille's, the genera are particularly well defined. It forms two octavo volumes, handsomely printed on fine paper, price \$5. . . .

A friend of mine starting for Italy promises us a complete herbarium of that country, from a friend of his professor in Naples.³⁸

Among the records preserved in the University of Kentucky Archives is a receipt dated October 31, 1829, "Mr. Peters to Louis G. Carrun [?], to tuition in the french, 7⁰⁰." ³⁹ It is interesting to speculate whether this study was provoked by an interest in reading the book by Conte Dejean.

A second letter from D. B. Shnabel, per Mr. F. Shoales, dated July 29, 1829, follows:

Your letter of 20 inst. came duly to hand, by which I perceived with much Pleasure that you are still progressing fast with Botany, as I have not, till now, been able in spite of all Inquirements I made about you and our associates respecting this Subject, to hear from you, and having been very much hindered myself in attending to Botany this Season, particularly in the early part, by an impaired State of Health, I neglected writing to you before now.—A List of all I collected, excepting those the names of which I sent you last year is as follows:

Viola martia	March	white and blue	in gardens
Crocus verous [?]	"	yellow and blue	" "
Bellis perennis	"	red	" "
Stellaria Lanceolata	Apr.	white	in moist low grounds along rivulets
Ribes floridum	May	yellow	in gardens
Magnolia glauca	May	greenish	on rich hilly grounds
Pinus rigida	May	white	on poor " "
Liriodentron tulipifera [sic]	(May)	greenish white, tinged with red	on rich ground
Lysimachia spicata	June	yellow	moist rich ground
Spirea opulifolia	"	white	stony moist gr, sides of rivulets
Veronica scutellata	"	white	moist low gr
Osmunda interrupta	"	brown	swamps
Carex crinita	"	"	meadows
(Carex) rosea	(June)	(brown)	(meadows)
Lechea racemulosa	July	brown	barren hilly gr.
Echium vulgare	"	blue	on sandy beaches of the Ohio
Isanthus coeruleus	"	blue	" " "

A worck licke Etons manual I stand much in need of.—I am also glad to hear that you have increased your Library by 2 valueable works and should like to lend them from you for a while if you would have the goodness to spare them for a short time.—I am much pleased to hear that you have received some foreign Plants and shall be happy to see them if you will be so kind as to send them down by some one of our People who will give you a call in the course of a week or so. . . .⁴⁰

The following letter, illustrative of the unreasonable requests to which any scientist of stature is subjected, unconsciously contains its own humor:

From W. A. Hitchcock, Castleton [Medical College], V[ermon]t, October 18, 1829, to Mr. Robert Peter, Jr., Pittsburgh, Pennsylvania. With care and haste.

Friend Peter

As I can obtain no regular history of Botany, except from Rees Encyclopedia, and as that is in the hand of almost every person I do not wish to copy from it. I therefore request you to collect all the facts in your possession or in the possession of your friends, that have reference to this subject, and write them in the form of a *dissertation* or *lecture*. I intend that my inaugural thesis shall be upon the History of Botany, and as we are allowed to collect from every source materials for the *Superstructure*, I have thought proper to call upon you—knowing your willingness to communicate knowledge where requested. If I do not misremember I saw an introductory lecture of yours containing a pretty complete history of the science—its rise and progress etc. etc. Give us a complete and well arranged history. . . [paper torn]. . . my Dissertation is near at hand.—as near as the 10th of December. I have collected from various parts a considerable number of minerals, and am only waiting for leisure to take a tour over the Green mountain before I send your box. The cold weather came on so soon last fall that I was totally unable to collect minerals of any sort. . . .

Write me immediately after receiving this and if you have room, give us a little information respecting your movements in New York last fall. You and Bagley gave us the slip I believe—

Yours in great haste

W. A. Hitchcock⁴¹

S. P. Hildreth of Marietta, Ohio, wrote to R. Peter Jr. Esq., care of G. Avery, on November 15, 1829:

Dear Sir, after delaying a long time, I have at last put up for you a box of minerals, selected from the best of those recvd this summer, containing 55 varieties—they are small, but the best that I could furnish, as I had to break them from my own not having duplicates—some of them are rare and I think very beautifull—I have not been able to procure for you the Colombo—two persons whom I engaged to perform that service both neglected to do it at the proper season, they living 4 or 5 miles from the locality and none being within 10 or 12 miles of me. I have sent however a beautifull flower from the Praire near Dayton O[hio] which you can describe at your leisure this winter—I shall try an other season for the Colombo and hope to be more successfull. . . .⁴²

William P. Gibbons of Wilmington [North Carolina], wrote to Peter on April 23, 1831, as follows:

. . . I now write to you for the purpose of coming to a more extensive understanding on various subjects; among these that of *botany* must receive a primary consideration. Your suggestions on this were very acceptable and gratifying inasmuch as it is my favorite study and one in which my interest waxeth stronger and stronger; it is therefore with much pleasure I accede to your proposition of an exchange of specimens, not doubting but that I can furnish you with an interesting and valuable collection to the amount of between 250 and 400. My older brother has collected about 400 from within our immediate neighbourhood; but I will not decidedly promise so many, as I am not altogether certain of being able to devote a sufficient portion of my time to the pursuit.⁴³

Referring once more to Peter's own "Catalogue of Plants about Pittsburg," the spring following the session at Rensselaer found him again adding to his collections, carefully cross-referencing back to earlier numbers. He continued that year, with heavier collecting, on into August and September, perhaps compensating for the previous year's absence during those months, and ending with "*Solidago ulmifolia* ?" on October 13.

1830 brought fewer and more abbreviated entries, a still different set of plants and, again, cross-referencing to earlier collections. The same was true for 1831. Entries were many fewer in 1832, ending with number "437, *Sison trifoliatius* 5.2 w July 1 Hill side form [?] oval compressed laterally, ribs scarcely visible in young state."

Peter already must have gone to Lexington, "somewhat reluctantly," by his own statement.⁴⁴ On April 14, 1833, he had written from Pittsburgh to James Lambdin, Louisville, in response to the offer of the Chair of Chemistry at the Louisville Medical Institute. Peter was gratified by the offer but felt himself "bound in honour to my Lexington friends for a year at any rate."

I propose moving down the latter end of this week, and as I take the family along I shall not probably be able to go to Louisville at this time. . . . If there is any cause of detention at Maysville I will step on a steamboat and pay you a visit.⁴⁵

A discrepancy in Peter's numbering should be pointed out here. Seven very brief entries are shown for Pittsburgh, April, 1833, with the locality, "hill side,

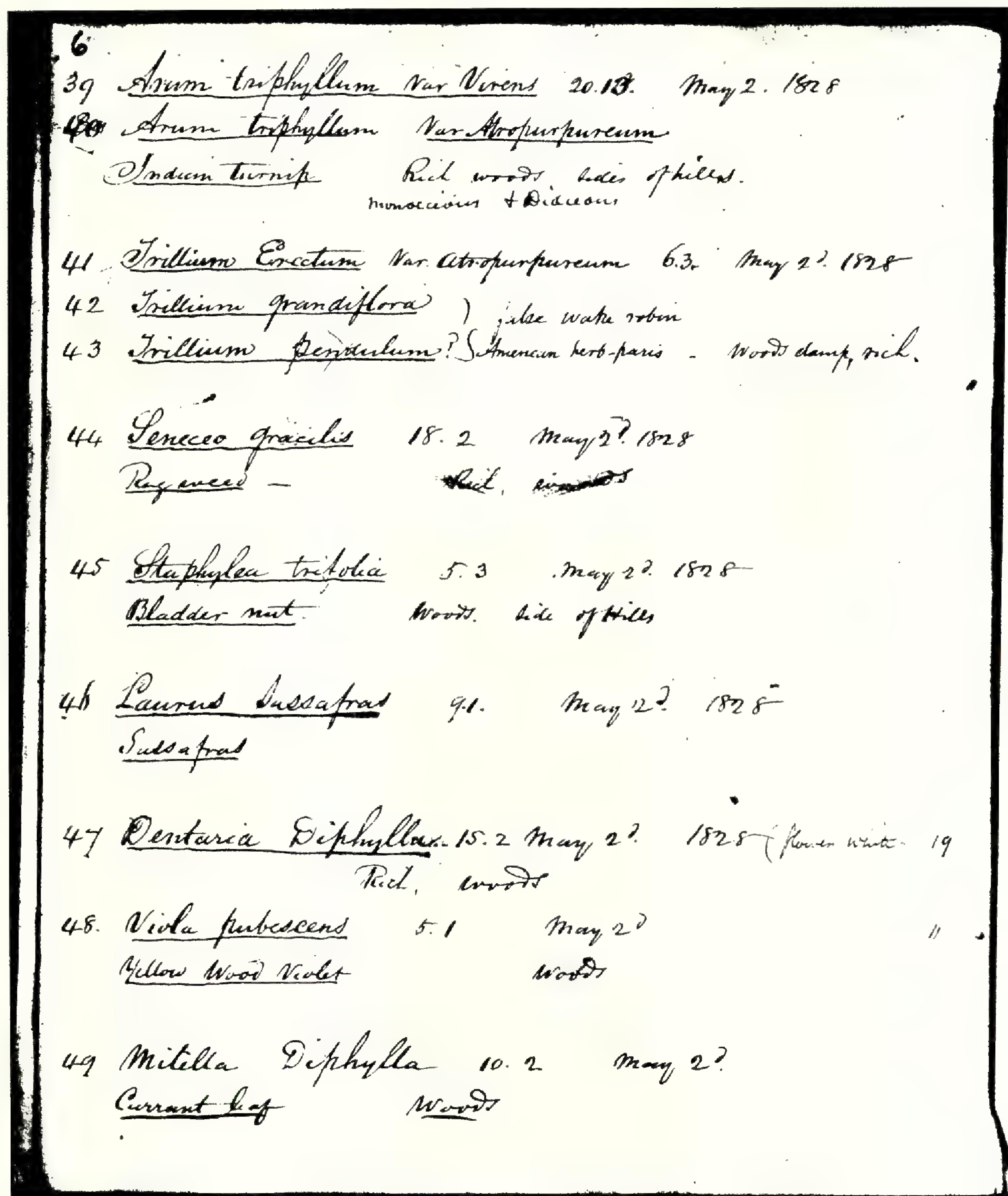


FIG. 3. Page 6 of Peter's "Catalogue...", listing plants from the Pittsburgh area. (Peter's "Catalogue..." is the property of the University of Kentucky Libraries.)

woods." The first, *Corydalis aurea*, bears the number 438. The next six specimens are numbered 560 through 565. The Kentucky collections, starting "1833" on the next page, begin with 439. The Pittsburgh plants may have been collected during a short visit back to settle his affairs⁴⁶ and not assigned numbers until June of 1833, when a break in his Kentucky numbers accounts for the six used.

Of the 445 plants listed in his Pittsburgh "Catalogue," only ten are represented at MICH. Others found during this investigation are listed in Appendix B.

It is not surprising, given the vigor of his scientific activity in Pittsburgh, and the breadth of his correspondence, that Peter was invited in 1832 to give a course of lectures on chemistry at Peers' Eclectic Institute in Lexington, after which he became associated with Transylvania University.⁴⁷

Arriving, then, in Lexington in April of 1832, Robert Peter must have at once renewed his acquaintance with Hezekiah Eaton, who was terminally ill of tuberculosis. A poignant note from Eaton to Dr. Short, written on August 4, 1832, only twelve days before his death, read thus:

Dear Friend,

My plants etc. are all moved into Mr. Bell's room, under the Library. I should be very much pleased if you, at your leisure hours, when you feel so disposed, would look through the different bundles, books, etc.

Many of the plants are not labelled which you are familiar with, others from the last (if labelled long ago) may be wrongly named—or not named at all. If Mr. Peter would look over such plants with you—he might name them for me.

I am anxious that *you* should know what plants I have.

The plants are in the large case, some in the new books I believe.

You will see that I began to arrange them according to Torrey's Lindley.

Your, truly,
H. H. Eaton⁴⁸

KENTUCKY (1833–1835)

Peter, invited to Lexington to fill the place of young Eaton in teaching at Peers' Eclectic Institute, soon made the acquaintance of Charles Wilkins Short, and there again followed in Eaton's footsteps as Short's companion in trips afield to collect and study the plants of the surrounding countryside.

Dr. Short, Professor of Materia Medica and Medical Botany at Transylvania University since 1825, and thirty-seven years old when Peter first came to Lexington, came from a background of wealth and culture very different from that of the young, largely self-taught chemist and naturalist.

They joined, however, in the study of medicine and botany, which were compatible interests in the new pioneering civilization west of the Allegheny Mountains, where "there was a great demand for medical men capable of identifying and instructing others to identify and gather the plants needed in medicine."⁴⁹ A leather-bound narrow notebook in Peter's handwriting, in the Transylvania University library at Lexington, contains "notes on Dr. Short's lectures on medicinal plants, and other aspects of medicine." It is dated January 22, 1834, and begins with instruction in the method of preparation and the medicinal attributes of *Aristolochia serpentaria*.⁵⁰ Druggists' lists of the period named such items as Gum Benzoin, Powdered Colombo, white Hellebore, Serpentaria, Sarsaparilla, Extract of Aconite, Belladonna, Cicuta, Taraxicon, Black Walnut, Gentian, Oil of Anise, Clover, Lavender, Juniper, Pennyroyal, Horsemint, and Sassafras.⁵¹

Before coming to Transylvania, Short had combined the practice of medicine with botany. As he traveled on horseback or in a carriage the long distances required of a country doctor, he observed thousands of plants, and gathered and carefully preserved hundreds of them for future study and to be sent to friends. By 1818 many of his beautiful and well-preserved plant specimens were in the Academy of Natural Sciences of Philadelphia. Thomas Nuttall at that time recommended Short to Constantine Rafinesque as "the outstanding botanist west of the Allegheny Mountains" and as possessing "the largest herbarium in the West."⁵²

After teaching a course in local botany in the summer of 1827, Short began the compilation of a local flora, as an aid to beginning botanists. In the first issue of the *Transylvania Journal of Medicine and the Associate Sciences* he began his

“*Florula Lexingtoniensis, or A Descriptive Catalogue of the Phaenogamous Plants Indigenous to this Portion of Kentucky.*” In two years his “*Florula*” passed through a Prodrromus and four Fasciculi.

With Hezekiah Eaton he made numerous trips to different streams in central and north-central Kentucky, Dr. Short collecting plants and Professor Eaton gathering shells, amphibia, snakes, and other zoological specimens. The two looked forward to the eventual publication of a “*Natural History of Kentucky.*”⁵³ After Eaton’s death, Short was joined by Robert Peter and Mr. Henry H. Griswold.

[Short’s] memoranda of botanical excursions show that during 1833 he made 15 major excursions which required 48 days and covered 821 miles in a carriage or on foot. In 1834 he made 22 excursions, requiring 33 days, and traveled 928 miles. Between 1833 and 1838, he gathered, preserved, and distributed to friends and organizations at home and abroad the enormous sum of over 28,000 specimens. He received collections in return and his herbarium became the largest west of the Allegheny Mountains.⁵⁴

After Short’s death, this herbarium was given to the Academy of Natural Sciences of Philadelphia, where it now remains.⁵⁵

Notations in Peter’s “*Catalogue*” confirm that he shared many of these excursions to such localities as the Kentucky River, Elkhorn Creek, Red River, Blue Lick [Battlefield], and the estate of Short’s brother, John Cleves Short, at North Bend, Ohio [near Cincinnati].⁵⁶

The three friends, Short, Peter, and Griswold, botanized the areas around Lexington so thoroughly that it “was difficult to find an unfamiliar species.”⁵⁷

Building upon the earlier published “*Florula*” of Dr. Short and working from their large collections, Short, Peter, and Griswold began in 1833 to publish, in the *Transylvania Journal of Medicine and the Associate Sciences*, a list of the “phaenogamous” plants and ferns of Kentucky. The first list published as a catalogue contained over 871 species. The first, second, and third supplements, containing 116, 211, and 78 species respectively, were published in the same journal, while the fourth supplement, containing 69 species, was published in the *Western Journal of Medicine and Surgery*. The last three supplements were published by Short, without the aid of Peter and Griswold.⁵⁸

The publications in which Peter actively collaborated, and for which he was co-author, are:

Short [C. W.], [Robert] Peter, and [H. A.] Griswold. 1833. A Catalogue of the Native Phaenogamous Plants and Ferns of Kentucky. *Trans. J. Med. Assoc. Sci.*, 6: 490–501.

Short [C. W.], and [Robert] Peter. 1834. A Supplementary Catalog of the Plants of Kentucky. *Trans. J. Med. Assoc. Sci.* 7: 598–600.

Short, C. W., and Robert Peter. 1835. A Second Supplementary Catalogue of the Plants of Kentucky. *Trans. J. Med. Assoc. Sci.* 8: 575–582.⁵⁹

An editor’s note at the beginning of the *Catalogue* states:

The following Catalogue is doubtless very incomplete since it includes only those species which have fallen under the actual observation of three of our botanical friends, who are still diligently extending their researches and daily adding to the number. It is, therefore, offered at the present, as an outline, faithful so far as it goes, of the Botany of Kentucky. The arrangement and the names are those adopted in the 6th Edition of Eaton’s Manual.⁶⁰

A comparison of Peter’s manuscript “*Catalogue of the Plants of Kentucky*” with the published *Catalogue* shows a high correlation. Of the 460 plants he collected

Time has awarded the decision to Rafinesque, and Short and Peter's proposed name has been abandoned. The difference of opinion, however, sheds light on the derivation of the specific epithet, "*sphacelata*." *Gray's Manual of Botany*, Eighth Edition, says, "(blighted, application not explained)."⁶⁵

Examining again Peter's "Catalogue," one finds an interesting digression toward the collecting of an alga:

[No.] 716 *Lemanea corallina* (Bory) (Diction[naire] des Sciences naturelles) in Wolf's run (blackish smokey colour) frond undivided terete with inflated nodes filled with a gelatinous fluid. About 6 or 8 in. long in tufts on rocks in rapid places und[er] the water—nodes about 1/4 in. apart. *Chaetransia* [?] *fluviatilis* (DC.) *Lemanea fluviatilis* (Agardh) *Conferva fluviatilis* (Lin.) *Polipherma* [?] *fluviatilis* (Vauch.).⁶⁶

Yet another reference is mentioned following [No.] 727, *Urtica urens*: "See Elliott for desc[ription]."

More than once, Peter wrote in complete Latin descriptions: "[No.] 714 *Cardamine Ludoviciana* Hook. *Sysimb[rium] Ludov[icianum]* Nutt. MSS. March 17, 1834, Winslow's thicket. (See 804 for Descrip[tion].)" Following the entry [No.] 804, he wrote: "*Cardamine Ludoviciana* (No. 714) description from Botan[ica]l Miscellany—by Dr. Hooker⁶⁷:

*Caulibus procumbentibus; foliis inferioribus bipinnatifidis laciniis lineari-oblongi, superioribus pinnatifidis hic illic grosse dentatis laciniis linearibus lineari-spathulatique, siliquis erectis linearibus planis obscure venosis stylo brevisculo terminatis, sinuibus [?] orbicularis compressis limbatis—Symbrium [sic] Ludovicianum Nutt. MSS. Hooker says the northern *C. Virginica* does not differ from *hirsuta*.*

By early 1834, Peter was struggling with sedges, as evidenced by a sprinkling of question marks among his entries.

He occasionally recorded comments on the weather. "Ap[ri]l 15, 1834 (Thermom[eter] 78° at noon). Nearly as warm for some days past, rain about every day." "Sunday 27th Ap[ri]l, 1834. Severe frost. Therm[ometer] 26° in morning, ice 1/4 in."

An especially interesting entry is:

[No.] 616, *Agave virginica* July 20, 1833. Dry. Hill, near petrified falls of Elk run, Rogers', Kent[ucky] river. Very succulent, leaves when crushed seem a mass of mucilaginous pulp. It retains its moisture with great pertinacity. Portions of the plant were exposed to the scorching heat of the sun when the thermom[eter] must have stood at nearly 120° for half an hour while we were walking to the house; they were afterward exposed to a free current of air in the porch for four hours more, without sensibly wilting. All attempts to preserve this plant without previously scalding it would be unsuccessful as Dr. Short informs me the flowers are speedily separated [sic] from the stem, which would remain alive between the papers for a very great space of time. After it has been scalded, the moisture may be expressed from it, like water from a sponge, soon wetting through 3 or 4 driers (formed of 4 sheets of bibulous paper) successively. It then dries readily but becomes discoloured.

The juice pressed out of the spike & stem stained the paper of a beautiful purple-colour which did not fade in the sun for a considerable length of time.⁶⁸

So, throughout 1833 and 1834, he collected and studied, collaborating on the work of the *Catalogue*, building his own herbarium, exchanging specimens and corresponding with others. He was co-author with Dr. Short of a species of *Stellaria*—*S. fontinalis* (Short & Peter) Robinson,⁶⁹ proposed by them as *Sagina fontinalis* in *A Supplementary Catalogue of the Plants of Kentucky*.⁷⁰ In his "Catalogue," Peter had agonized over that plant, with much crossing out of possible names.

[No.] 725 *Sagina* [*diffusa* crossed out] [*micropetalum* crossed out] [*maritima* crossed out] [*procumbens?* crossed out] *fontinalis* N.S. (Lin[naeus]. says caps[ule] 4-loc. in *Sagina*, the french authors & Hooker say *one-celled*.) Wet, on cliffs in places where springs flow over the rocks, near Rogers', Ap[ri]l, 1834. Cannot distinctly see 4 cells to the capsule (too young to examine). May 3, found it on Elkhorn in spring on cliffs. Glabrous, branching (dichot[omous] above). Capsule 4-valved somewhat 4-sided, *one-celled*, many seeded, stamens 4–6, stigmas 4, calyx 4–5 leaved—apetalous; leaves spatulate-linear, obtuse, opposite, smooth, entire; ped[icel] solitary, axillary [sic], alternate, longer than leaves, (8–12 inches).⁷¹

In the *Supplement*, Short and Peter wrote:

Sagina **fontinalis*. Stem procumbent, branching, dichotomous above; leaves opposite, linear-spatulate, entire, pedicels solitary, alternate, longer than the leaves. Annual.

Glabrous, apetalous; calyx 4–5 leaved; sepals ovate, obtuse; stamens 4 to 6; capsule somewhat 4-sided, one-celled, many-seeded.

Hab[itat]. On the cliffs of the Kentucky river and Elkhorn creek; forming mats in wet places where the water of springs flows over. Flowers in April and May; stems 8–15 inches long.⁷²

A note appended to the species description in *The new Britton and Brown illustrated flora of the Northeastern United States and adjacent Canada* (Gleason 1952) comments:

Known only from wet places on cliffs, Lexington, Ky. and Nashville, Tenn. Its characters are inconclusively those of *Stellaria* and in some respects, particularly the entire petals, the 3-valved capsule, and the muriculate seed, suggest a closer relationship to *Arenaria*. May–June. [*Alsine fontinalis*, B. & B., Small.]⁷³

Another plant selected for especial mention in the *Supplementary Catalogue* was *Cunila glabella*, where it was stated:

Cunila glabella. This is undoubtedly the original plant of Michaux, and it agrees much better with his description than do specimens which under the synonymous name of *Hedeoma glabra* we have received from the Niagara falls. Our plant is usually from 1 to 2 feet high; its larger leaves 2 inches long by 3/4 broad, coarsely serrate towards the apex, attenuated at base, and distinctly petioled; whorls from 3 to 15 flowered.

Hab[itat]. We have only found this plant in one locality, on the borders of a rivulet emptying into Elkhorn, at the Forks near Frankfort, Ky. At this point in rich soil among fragments of limestone (a locality altogether analogous to Michaux's original one), it occurs in great abundance, flowering in June. From an accurate comparison of the two plants we are compelled to believe that the New York species is distinct from the present—and we prefer for our plant the name given by Michaux, although our specimens were all distinctly didynamous.⁷⁴

In his own "Catalogue," Peter recorded, "[No.] 794 *Hedeoma glabrum* ?" then crossed that out and continued:

Cunila glabella M[ichau]x the true one. June 27, 1834. from Dr. Short (bank of a creek road to Frankfort). Stamens all fertile, corol[la] urceolate, with short contracted tube, flowers on long ped[unc]l[e]s and verticillate 'in more than 3.' (3 to 12). leaves with a few serrations near the summit. Michaux's name *Cunila glabella* is better, it approximates *Cunila* more than *Hedeoma*. See Torrey's flora whose opinion of the existence of 4 stamens is correct.⁷⁵

Continuing their relatively wide-ranging trips (Rodgers', for example, located on the Kentucky River near the Richmond Road, was about sixteen miles below Lexington, no small distance by horse transportation), the friends worked at their

botanizing spring through fall of 1834, going on September 30 to a marsh twelve miles on the road to Frankfort for *Heteranthera lunaria* and *H. reniformis* “in abundance.” (Peter’s “Catalogue,” No. 133). During that year, they had collected not only close to Lexington itself, but often at the above-mentioned Rodgers’; at the Blue Lick battlefield in Nicholas County; the Red River at Forge, in present-day Powell County, near Irvine; Shaker’s Ferry between Mercer and Jessamyn counties; Boonsborough in Madison County; and Raven Creek in Fayette County. Last collections of the year were taken on October 16.

In 1835, changes began to come, presaging a shift of interest on the part of Robert Peter.

Looking over his “Catalogue” entries for that year, one finds him beginning in normal fashion on May 1, with plants from the vicinity of Lexington. Then, on May 23, “Shaker Ferry, upper 16 [+] 16 [+] 5 [total] 37 miles \$5.50,” followed by a list of forty-one early summer plants, including several carices, usually “?” This was the first time he had entered mileage, and may have been done in imitation of Dr. Short’s careful record-keeping, or may have indicated a trip to conduct a chemical analysis, with plant-collecting a secondary activity.

Nine plants from Blue Lick, June 4, were attributed to Dr. Short.

On June 6, he discussed *Euphorbia obtusata*, “Habit and appearance much like peplus but capsules muricate—leaves spatulate *sessile* and serrulate; involucels broad ovate sub-cordate.” He was still carefully studying plants.

Several more excursions were noted, giving mileage and fees—June 20, old paper mill on Wolf Run, 5 miles, \$1.00; July 1, 2 & 3, Blue Licks, 83 miles, \$8.00; July 11, Kentucky River, Clay’s Ferry, Rogers’, 29 miles, \$.50; August 2 and 3, Crab Orchard, 140 miles, \$12. Under the last entry, he wrote a two-page mineral analysis of the springs at Crab Orchard,⁷⁶ this followed by a list of forty-five plants collected, with generally diminished descriptive comments, but a lengthy discussion of “*Dicksonia pilosiuscula?*”.

A trip to Olympian Springs, August 10 to 20, 1835, under which he noted, “150 m[iles] \$20—),” netted a list of fifty-seven plants, recorded with brevity. His interest in chemical analyses was becoming ascendant.

Seventeen plants from near Lexington were listed following the entry, “about 30th [of August].”

Then came fifty-two plants attributed to Dr. Short, from a number of localities, such as Rodgers’, Louisville, Mammoth Cave and the Barrens near there, Ohio and Salt Rivers. The dates on the Short specimens were all September, 1835.

The lessening collections of 1835 were probably due to two main causes—his increasing interest in mineral analysis, as verified by the entry under Olympian Springs, and to his impending marriage. After October 6, 1835, when he was married,⁷⁷ domestic obligations must have replaced his bachelor-naturalist trips afield and contributed to a narrowing of his scientific activities. Apparently his own active collecting ended with August 30.

Peter’s “Catalogue” ends with a comment penciled in by his son, A. M. Peter, over a hundred years later, on June 28, 1942:

Total numbers	935
Add for half nos.—2 duplicates	<u>6</u>
Total species	941
At Pittsburg	<u>444</u>
Species collected in Kentucky	497

Turning again to another aspect of Peter's botanical work, one should take note of his writing. He was, as stated earlier, a "ready and prolific writer" on a number of subjects, including history, local politics, chemistry, medicine, geology, and archeology, as well as botany. A comprehensive listing of his published writings may be found in the Bibliography of John Dean Wright's thesis⁷⁸.

In his later years, among numerous articles having practical benefit for the farmer, were three for the *Farmer's Home Journal*: "The Uses of Weeds," May 16, 1867; "Blue Grass and Orchard Grass, etc.," June 13, 1867; and "Blue Grass, Its Origin," June 13, 1867.⁷⁹

Peter's Commonplace Book,⁸⁰ begun in 1833, sheds further light on his precise mode of work. He painstakingly copied from Willdenow's *Principles of Botany and Vegetable Physiology*, "a table of the principle [sic] colours of plants etc. used more particularly in the fungi and lichens." Pages 3 to 6 display neat rectangles of watercolor with names of the colors they depict, for example: "24. *Croceus*, saffron color, dark orange," and "28. *Atropurpureus*, a very dark red, almost approaching to black."

From the same source, Peter copied detailed descriptions of plants having unusual characteristics (i.e., the spontaneous motion of *Hedysarum gyrans*)(p. 7) or accounts of plant experimentation. (p. 8)

At the bottom of page 6, he copied the characters used by Linnaeus in describing flower and plant structure. On subsequent pages, Peter copied extracts from various sources. From White's *Natural History and Antiquities of Selborne* came instructions in the use of the fern *Polytrichum commune* which, "well combed and dressed and divested of its outer skin. . . becomes of a beautiful chestnut colour, and being soft and pliant, is very proper for the dusting of beds, curtains, carpets, hangings, etc." (pp. 9-10) He made notes, from Humboldt's *Travels*, of the capability of some plants of supporting high temperatures (p. 14), and of the making of spirits from *Agave americanus*. (p. 18)

In the wider field of botanical writing, Peter's chief contribution was his collaboration with Short and Griswold on the previously mentioned *Catalogue and Supplements*. His extensive personal correspondence, continued during his years in Kentucky, also illustrated the state of science at that time, often being in themselves small botanical discussions.

By no means are all of Peter's botanical letters included in this paper. Hundreds of letters, on botany and a variety of scientific topics, are listed among the holdings of Transylvania University, Lexington.⁸¹ I have used only a few of the more representative ones.

On August 10, 1833, Elias Durand wrote from Philadelphia to Peter.

. . . I am much gratified in renewing with you a correspondence upon the Subject of our favorite Science. In this respect you have anticipated my wishes as I was preparing for you a catalogue of north american plants with indications of such as I have in my collection and of which I have duplicates; but I shall not be able to finish it before I receive, from Dr. Darlington and others, plants owing to me from previous exchanges. . . . Dr. Griffith who stands at the head of the Philadelphia botanists and has the largest collection is disposed to exchange with you not only plants but marine and foreign land shells for land and river shells of your region, Mr. Peale also.

. . . The 7th volume of Berzelius has been received.

. . . My catalogue of american plants is made from Dr. Beck's botany of the northern & middle states. This new work which is arranged according to the natural system is of great value. Dr. Beck has followed the classification and nomenclature of DeCandolle. You know how long this celebrated botanist has been labouring to give to plants the most

proper names—and put a stop to the confusion introduced in botany by the various Synonyms given to the same plant, either from error, ignorance of anterior work, or mere whim of our savants. DeCandolle's researches on the rights of the different authors as to priority and preference tend to settle who has closely followed the part of the prodromus of D. already published will be of great service to us all.^{81b}

On March 9, 1834, Clarendon Peck wrote from Lovelace, Louisiana:

"Friend" Peter

"Yes" I am glad you put an end to the silence. I had not forgot my promise—had already wrote you a letter long since but thinking perhaps t'was only through politeness exacted as *you* are a *polite fellow* did not forward it—& afford myself the pleasure of hearing from you—so its unnecessary to mention the pleasure the unexpected arrival of your letter gave—the pamphlet I have not yet received though I feel as much obliged as if the contents I had perused—it will come perhaps by the next mail—I have been delicate so long that although now greatly improved indeed—yet it takes but little to put me back—the least fateague or over exertion has been and is now attended by considerable injury to my system—taking some little time to gather up again—so I can hardly tell whether it will be in my power to profit much in the *plant* way in this paradise of Botany. I see a good many of our old acquaintances as the *Trillium Sessile*, *veronica's*, *Ranunculous* etc. the former has its petals much longer & rather linear—my little *Phlox* grows very abundantly along the bluff & there are two other plants I have not yet found out. The remaining plants met with as yet are the *Krigia caroliniana*, *myosuros minimum*, *Evolvulus nummularis*, *Listera cordata*, *Viola pulmata* & *V. heterophylla*, *Obolaria virginica*, *Coroloriza odontoriza*, *Ranunculous pusillus* etc. If I had only my former vigor I could furnish a much more extensive list—the oaks, Sweet-gum, maple, Elm, Plum, Peach, *yellow jasmine*, *candle berry*, *myrtle* etc. either have been, or are still in bloom. There are 4 kinds of squirrels all different & larger than the species in Ky—they are the *Sciurus niger*, *S. magna caudatus*, *S. capistratus* & one with a suttly black back, belly & tail—black feet & head dark brownish grey—I have some curious Indian instru[page 2]ments (which were plowed up from about the various mounds with which this country abounds in—are formed mostly of the different varietys of *hornblende* rock & *jasper*—some *Selenite* from the Ouachita gave me by a gentleman, & a few crystals of quartz that were picked up in different places. also a few snail shells that may serve as a nucleus to further collections. I am very much pleased with both country & climate. the changes of weather are so sudden to the finest pleasante, from the disagreeable wet, that one soon forgets the existance of the latter.

your affectionate friend

Clarendon Peck⁸²

On August 1, 1834, Elias Durand again wrote:

I received about two weeks ago the box of plants you and Dr. Short had the goodness to send me. The package directed to Dr. Griffith was handed to him the same day. We were not disappointed, I assure you, in the expectation we had entertained of getting from such a source the best samples we had, as yet, the chance of adding to our collections. What may have been your best duplicates, if those we have received from you were but the remainder of your last years collection? They were magnificent and eclipse our best. I hope the wound our *Amour-propre* has received in this instance will stimulate our efforts in selecting and drying the specimens we shall hereafter collect.

The greatest number of yours and Dr. Short's specimens are extremely valuable. The *Hottonia inflata*, seldom found in this neighbourhood. The *Virgilia lutea*, *Dionaea muscipula*, *Aster Shortii*, *Iris verna*, *Sedum pulchellum*, *Iresine celosioides*, *Enslenia albida*, etc. etc. are among the most interesting. I do not conceive how Pursh has for a moment mistaken our *Hottonia* for the *H. palustris* of Europe. There never were two species of the same genus so different from each other. As Dr. S. and yourself may not have seen the European species, I send you a sketch of it for comparison. [Note: A charming pencil sketch of the plant in question was appended.]

I have not been able, nor will I have time before next fall, to examine critically and compare the plants you sent me, according to your request. The same I ask of you with

respect to all the plants that I will send you. I will tell you, en passant, that your Aster no. 687 is our *Salicifolius*: the one, [?] I believe, 689 that has a great affinity with the *patens*, seems to me a new species; I should like to see the radical leaves. They were wanting in the 3 specimens I received from you and Dr. Short. The *Psoralea eglandulosa* is the *Melitoides* of Mich. and Willd., *Melilotus psoraloides* of Nutt. *Eglandulosa* is a synonym and not a distinct species as Mr. Eaton will have it. Your *Spermacoce tennior* may be the *glabra*; but certainly it is not the *Hedyotis*.

Following bits of news and gossip concerning local botanists and the Philadelphia Academy, Durand continued:

Old Rafs would willingly exchange the rare plants you will send him for his trash, but yet it would be prudent not to let go your package without holding his with the other hand. I will probably see him this evening, as he passes every day before my door and I will ask him about the *Nelumbium*—But he is not to be trusted.

Among the plants you have discovered this season, I should like to have the following—*Lemanea*—*Poa pungens*—*Sagina maritima*—*Stylopus verum* of which I have a bad sample from Raf.—*Prunus obovata*—*Houstonia ciliolata*, *Triosteum angustifolium* (I have indifferent spec of both), *Koeleria truncata*—*Arrhenatherum kentuckensis*—*Ranunculus pusillum*—*Hypopeltis obtusa*—*Cunila glabella*—*Potamogeton compressum*—*Gonolobus macrophyllus*—*Tragia cordata*—*Seymeria macrophylla*—*Bletea* [?] *aphylla*, etc.

. . . [Addendum on back of letter:]

Written under the directions of Professor Rafinesque, etc. etc. etc.

The *Nelumbium luteum* grows *in the river Kentucky* in a pond on the margin of the river, 4 or 5 miles above Frankfort, on the north side—on the right bank—The very rare *N. pentapetalum* of Walter grows in the marshes, west of Andersonville, about six miles of Anderson and 4 miles of the Ohio river.

Querita and invenictis?

[Listed along the edge of the address side of the sheet were the following, apparently a continuation of the above list:]

Glyceria fluitans; *Sisymb. canescens*?; *Cardam. Ludoviciana* (Hook); *Agrim. suaveoleus*; *Boemeria cylindrica*⁸³

In a letter to Dr. Short dated "Philadelphia, 5th May, 1834," C. S. Rafinesque had written, "I have lately seen a small collection of plants sent by you and Mr. Peter to Mr. Durand of this city. . . ." ⁸⁴

Again on September 2, 1834, Durand wrote at length concerning his own resumption of plant collecting, making some comments about Peter's specimens, and making another acerbic thrust at Rafinesque:

Whatever expectations may old Raf. give you in your exchanges, I advise you not to be too sanguine. All his collections from all parts of the world are as much negligees as himself, composed of incomplete and badly cured specimens, such as you would not place in your herbarium. If you are disposed to send anything to him, do it in a spirit of charity, but beware of sending anything to him new and unpublished, because he will take care to anticipate you and take for him all the merit of yours or Dr. Short's discoveries.

. . . A very short time before sending you my last invoice of plants, I had received from a friend a very indifferent parcell of European specimens, which I have not been able to find since. Will you be good enough to let me know whether I did not place it by mistake in the box I sent you. The plants intended for you were composed of a package of 184 american plants and another of 209 of European Specimens. The bundle I allude to contains about 300 plants labelled in a german hand writing and very indifferent. I will thank you to return it, if, per chance, I misdirected it.

. . . I have seen Dubarry about the box you directed for Mr. Halsey. He received it with the other boxes and sent it to its destination. I remember myself to have seen all your boxes 6 or 7 in number in Dubarry's store. I have also ascertained that the copy of Beck's flora has been forwarded by Desylver.

. . . My respects to Dr. Shortt—I do not forget I am his Debter.⁸⁵

In 1835 Peter was elected to membership in the Academy of Natural Sciences of Philadelphia. His letter of acknowledgement follows (Fig. 4):

Lexington, June 29, 1835

Dear Sir,

Be so kind as to express, for me, to the Acad of Natl Sciences of Philada, the highest sense which I entertain of the unmerited honour which they have done me in my election to Corresponding membership in that Institution, and be assured that if any effort of mine can in any way contribute to the promotion of the objects for which it was established, that nothing would afford me greater pleasure than to further the cause of Natl Science, which has always been to me the source of much pleasure and instruction.

If my Diploma be wrapped up and left with Messr. Desilver, Thomas H., Bookseller of your city, to be packed in any box for Mr. Skillman of this place, it would reach me in due time.

With sentiments of personal respect and esteem—believe me

Respectfully

Your most Obed. servant

Robt. Peter⁸⁶

To Saml. Geo. Morton, M.D.

Cor. Sec., Acad. Nat. Sc. of Phila.

In his continuing correspondence with other botanists, Peter expressed his opinions with frankness and humility, accepting corrections in the same spirit, as demonstrated in an exchange with John Van Cleve of Dayton, Ohio. Van Cleve wrote on August 18, 1835:

Mr Robert Peter

Sir

Your proposal of an exchange of botanical specimens, I accept with much pleasure. I have only begun, during the present season, to preserve plants, although I have been paying considerable attention to the study for a couple of years before. Consequently I have not yet made a large collection. The plants which I have found and examined in this neighborhood, I find generally included in your list. There are however some which you do not seem to have found in your state. I have specimens of the *Habenaria Psychodes*, *Lysimachia Revoluta*, *Melanthium Virginicum* and *Glaucum*, *Monarda Punctata*, *Delphinium Azureum*, *Dodecatheon Maedia* (white), *Euchonia* [?] *Pallens*, *Gentiana Crinita*, *Silphium Ternatum*, *Spirea Lobata*, *Trillium Purpureum*, *Viola Tenella* and undescribed species of *Valeriana*, *Hydrophyllum* and *Tradescantia*. I have duplicates of only a few of them however and shall not be able to send you any worth while until next season, when I think I shall have enough to make an exchange of some value. I shall also know by that time, better than I do now, what plants I should like to receive from you.

I am under many obligations for the pamphlets you have forwarded, and particularly for the one giving directions for preserving plants, which I have looked over with some profit. I have been in the habit of gathering flowers in a tin case, but have lately adopted a plan with some success, which I find better than any other where it is practicable. I have a box just large enough to contain a quantity of driers made of wood, with a board for the top fitting inside the rim of the box. I gather the plants and lay them immediately in the box between the driers, and then put in the top board and press it down with my knee and fasten it by buttons upon the edges, and they thus undergo their first slight pressure in the box in which I gather them. When I come home they are flattened and I then put them into the single sheets and rectify any disorder in their position and put them into the press. The box with paper in it would be too heavy and inconvenient for long rambles, but where by a

Lexington June 29. 1835

Dear Sir

Be so kind as to express, for me, to the Acad. of Natl. Sciences of Philad^a, the high sense which I entertain of the unmerited honour which they have done me in my election to Corresponding membership in that Institution, and be assured that if any effort of mine can in any way contribute to the promotion of the objects for which it was established, that nothing would afford me greater pleasure than to further the cause of Natl. Science, which has always been to me the source of much pleasure and instruction.

If my Diploma be wrapped up and left with Messrs. Desilver, Thomas & Co., Booksellers of your city, to be packed in any box for Mr. Skillman of this place, it would reach me in due time.

With sentiments of personal respect and esteem believe me

Respectfully

Your most Obedt Servant

Robt Peter

To Saml. Geo. Morton M.D.

Cor. Sec. Acad. Nat. Sc. of Phil.^a

FIG. 4. Robert Peter's letter, dated 29 June 1835, to Samuel George Morton, M. D., Corresponding Secretary of the Academy of Natural Sciences, Philadelphia. (Peter's letter is the property of the Academy of Natural Sciences, Philadelphia.)

short walk, as is often the case here, a locality can be found in which a large number of specimens can be selected at once, I prefer it to the tin case. We have every variety of land immediately around our town, each with its peculiar flowers—Dry prairies, wet ones, woods, hill sides, old and new fields, ponds and running streams.

I mentioned having species of *Hydrophyllum*, *Valeriana* and *Tradescantia*, which had not been described. I have not taken down a particular description of the first plant. The *Valeriana* is as follows:

Glabrous; leaves opposite; radical leaves on long creeping culms, with 3, 4 or 5 joints, at each of which is a pair of cordate, crenate or sub dentate leaves, on long petioles; cauline leaves, upper ones ternate, lower ones pinnate, with 5 or 7 ovate, acuminate, crenate-dentate divisions; petiole clasping, villose at the base; plant 2 feet high; flower light purple, numerous—from 100 to 300 or more on a single stalk. May.

The *Tradescantia* is as follows:

Stem erect, simple, culminate, with numerous short joints; leaves lanceolate not elongated, (their width being equal to one fourth of their length, which is about 8 inches for the lower leaves, and one and a half for the upper ones), pubescent, amplexicaul; peduncles axillary, short; flowers small, blue, upon pedicels which are enclosed between two leaflike bracts, terminating the peduncle, seven or eight of the axils having each an open blossom at the same time. July and August.

Rest assured that I shall consider it a pleasure to assist in increasing the general stock of knowledge of western plants, and to cooperate with all who take an interest in that object. As soon as I have a collection worth notice, I will send you a list, and forward you any specimens you may desire.

John W. Van Cleve⁸⁷

Peter responded on October 11, 1835:

I should have done myself the pleasure of answering your favour of the 18th Aug. much earlier but for the press of other matters that, in a measure, took away my attention from the subject of our correspondence. [Peter was married on October 6!] I need not tell you that I am much gratified at your acceptance of my proposal to exchange. Although our regions of country have many plants in common in them yet I must believe that an exchange of specimens will benefit us both, as much by adding new specimens to our herbariums as by exemplifying the difference of habit and appearance assumed by the same plants in different localities.

Dr. Short and myself have made a number of botanical excursions this past season, and my collection for the year is quite respectable. We have made many additions to the catalogue of Kentucky plants this year, which shall be forthcoming in the *Transylvania Journal* before long.

I shall commence tomorrow, the labour of the distribution of my duplicates into packages for my several correspondents, and in doing so shall make up one for you out of my [p. 2] whole collection, knowing that, although I may send you a great many things that you already have, the difference of *locality* will give them value; and hoping that my names may be corrected or verified by your experience and knowledge.

We also have found the *Lysimachia revoluta*—but only in small quantities—I should, therefore, be obliged to you for specimens—Our *Dodecatheon meadia*—of the Kentucky river is white flowered—Dr. S. has found the *Gentiana cornuta*, *Silphium ternatum* & *Viola tenella*—but still I should like specimens from you.

I think you will [be] better pleased after a fair trial with the plan which we pursue in the collection and preservation of plants, as stated in Dr. Short's paper, than with any other. The box of which you speak, in which you collect plants, must be a very cumbersome affair. I do not see how you can manage to carry home many specimens without being laden with a very heavy package. Nor do I like the plan of shifting the plants after they have been once put between the dryers—it is a loss of time, and you are always liable to injure the delicate parts, or to roll up the leaves, should the plant be flaccid when you attempt to move it. In the collection of very delicate plants which are injured by being carried home in the tin box, or which shed, or shut up their corollas, or which [p. 3] close their leaves, there is an advantage in collecting them and carrying them home in a portfolio filled with loose single sheets—but in this case the plants, single sheets and all, are put between the usual driers on arrival home. I express my opinions &c freely. You will excuse it. I have, as yet, found nothing to equal the tin box for collecting.

The new *Hydrophyllum* which you mention is probably the one which Nuttall has described by the name of *H. macrophyllum*, in 7th Vol. *Journ. Acad. Natl. Sciences Philada.*—and which Riddell has subsequently described in his *Synopsis of the Flora of the Western States* by the name of *H. hispidum*.

The *Valeriana* is the same with the one which we have, and which we have continued to call *pauciflora*, notwithstanding the number of its flowers—Richardson's name *sylvatica* would suit it much better—See *Beck's Botany of the Northern and Middle States* where he gives the following description of a plant which he supposes to be *V. sylvatica* found near Fairhaven, Vt.—Stem 2–3 ft. simple, smooth, erect. Radical leaves on long peduncles, usually simple but sometimes lobed at the base, varying from lanceolate, to ovate and subcordate; stem leaves pinnate, leaflets in 4–11 [?] pairs with an odd one, ovate oval or

somewhat rhomboidal, coarsely but sometimes very sparingly toothed. Flowers numerous, reddish-white, perfect, in a large and dense dichotomous corymb. Corol. gibbous at base, 5-cleft. Stamens & pistil much exerted. Capsule ribbed, as long as the narrow and hispid bracts.

If you have collected any seeds of showy native plants I should be much obliged to you for the same.

Very Respectfully
Robt. Peter

P.S. Direct me how to send the package of plants to you.⁸⁸

A second letter from Peter to Van Cleve was dated November 5, 1835.

I have the pleasure to acknowledge the receipt of a small package of plants from you, which came to hand, by way of Cincinnati a few days since and which, from the beauty of the specimens and the fact that most of them were new to me, afforded me a great deal of pleasure. The plants are as well preserved as they could be and of a proper size—all characteristic specimens, and form a strong contrast with those of a package which I have just received from Europe, which are small “bits” of plants, blackened, for the most part, in drying, and most miserably preserved. I have sometimes been disheartened on receiving such returns for the specimens about the preservation of which I have taken so much pains.

Before the receipt of your package I had put up for you a small box of above 300 specimens of plants of my last years collection, which now only waits an oppor-[p. 2]tunity by which to send it to you. As I at present know of no direct way of sending it to you, and, from the nature of my engagements, may not, probably, meet with anyone going in your direction soon, I would thank you to direct me how it can be sent so as to reach you in safety. Meanwhile, if I meet with any opportunity, I will forward it to you.

I have sent you, no doubt, a great many things which you have already, but it may be interesting to see plants from this locality, or to compare plants and names together. If you are able in return to send me any more, send duplicates or even more of as many as you can and especially of some of those which you have now sent: viz, *Liatris*, *Solidago*—*rigida* [?]*—stricta—Riddellii* etc.

In looking over your plants I find some old acquaintances among those with [sic] have no names. I can consequently furnish you with the names which we attach to them. I also find that I disagree with you in the names of some of the others, and shall, in the freedom in which all students of nature ought to write and speak, give you my opinion of them, which you may take for as much as it is worth, as I cannot set myself up as yet for infallible in such matters—To begin: The branching Aster—[p. 3] white flowered—leaves lance linear—is most probably *Aster diffusus*.

2. The aster in the same sheet—Blue flowered—leaves with long petioles—ovate & lanceolate—is *A. diversifolius*.
3. The large blue flowered aster—large flowers—leaves lance-ovate amplexicaulis—smooth—is *A. laevis*.
4. Your *Helianthus virgatus*—is perhaps *H. trachelifolius*.
5. That marked *Helianth. strumosus*—probably *H. mollis*
6. " " *H. altissimus*— " *H. giganteus*. *H. altis.* is purple-stemmed etc.
7. Your *Lactuca hirsuta* is a *Sonchus*—the pappus is not *striped*—It is perhaps *S. alpinus* or *S. floridanus* or something else.
8. The *Eupatorium* is most prob. *E. glaucescens*.
9. Your *Solidago procera* is *S. canadensis*.

These remarks, where I have expressed a doubt, I beg you to verify by studying the plants with the descriptions in the largest works which you have.

I should be happy to hear from you soon; and must repeat my *request* of you, that when you receive my package of plants, you will take the same liberty with them that I have taken with yours.⁸⁹

On January 10, 1836, Peter again wrote to Van Cleve:

By the time that this letter comes to hand you will most probably have received the package of plants which I have put up for you (about 310 species) and sent a week or more ago, through Louisville to care of Mr. R. Buchanan of Cincinnati, who will no doubt

forward it to you without delay. Mr. R. Buchanan is a merchant, and a Botanist, residing at the head of the steamboat landing, and will no doubt take as much pleasure in forwarding my packages to you as he would take in sending your packages to me. There is no very direct mode of communication between this place and Cincinnati by which small packages of the kind could be sent, but from Louisville they can be easily sent here. Directed to the care of Mr. Pettit, Druggist of Louisville they would soon find their way to me as I have a brother who resides with him. You will find at least *one* mistake in [p. 2] the naming of my plants which you will please correct on the label. Change *Ludwigia natans* to *Ammania humilia*. I would have done it myself but had not time. You will also give me the benefit of your criticisms and remark on my names & plants—take the same liberty with my package that I have taken with yours.

In addition to other favors which I wish from you I desire to get the *seeds* of as many of your handsome natives as you can obtain. Will you be so good as to gather them for me as they come in season. As I am also about commencing a small farming and gardening establishment I should be grateful to receive from you anything new in point of information, seeds, etc. which you may be able to communicate—for example cuttings, for grafts, of any remarkably fine fruit—or young trees if they are very good or can be obtained by purchasing. I can easily remit the money by mail.

. . . I will send our new supplement to the catalogue of our Kentucky flora as soon as it is printed.⁹⁰

Another comment on the problems of shipping packages at that time is found in a letter from Asa Gray to Charles W. Short, dated July 31, 1838:

I am happy to state that the long-lost box containing a parcel of plants from Dr. Peter to Saml T. Carey, Esq—the Transylvania Med jour for Lyceum, and (last not least), the Black-Walnut press for your humble servant, came to hand, about 3 or 4 weeks ago. It was sent, I believe, more than two years ago.⁹¹

That Asa Gray had more than a casual acquaintance with Peter and his work is shown in a letter written to Short some years later, on January 17, 1852:

I have just (in Pl. Wright) dedicated a fine Leguminous genus to the memory of Dr. Peter, your former associate: there are five specimens of it in the collection of Wright 1851, which you are to share in.⁹²

Willis's *Flowering Plants and Ferns* (1966) lists the genus, "*Peteria* A. Gray Leguminosae 3 SW U.S."⁹³

Peter's voluminous correspondence and exchange of specimens reached beyond the borders of the United States. Charles Parker wrote to him from Liverpool, England, on May 12, 1835, acknowledging the receipt of a box of "beautifully preserved Specimens of Plants," and promising to send Peter some of his own. He wrote that:

In point of beauty I never can hope to supply any Specimens that can at all approach to these you have sent. The moisture of our climate, my residence at some distance from the place of growth, and the [failure] of our young English Botanists [to devote] the attention they ought to the drying of their specimens. . . will I hope plead my apology for the indifference of many of the Specimens I have to offer you.⁹⁴

W. J. Hooker wrote to Peter from Glasgow, Scotland, on November 5, 1836:

My dear Sir

Let me thank you for some very nice Birds you have been good enough to send for my Son, William, & for your obliging offer, sent by Dr. Short, to supply me with more at a future opportunity. I can assure that they will be highly acceptable. I have two sons; of them one _?_ lively an interest in the Ornithology and the other (Joseph) in the Entomology of N. America, as I do in its Botany.

Dr. Short also sent me from you a Box of Plants to be given to some one, whom I had reason to believe would make a suitable return in European Plants. And here I have been much puzzled to know how to act. Often those who are the most able are least willing to give of their ample stores, and vice versa. At length about 3 weeks ago Mr. Wilson⁹⁵ of Washington came to visit me & on my showing him your specimens he expressed the greatest desire to possess them & to give you British species in return. So he took them away with him—and I do trust he will make you a suitable return.

Pray command me if I can do anything for you in this country & believe me to be, my dear sir,

very faithfully

Yours

W. J. Hooker⁹⁶

Although Peter continued to correspond on the subject of botany and to exchange specimens, the pressure of other matters reduced the emphasis on his botanical work. A quite lengthy letter to Elias Durand dated August 11, 1837, discussed the procurement of periodicals and chemical apparatus, and the troubles at Transylvania. Only near the end did a short paragraph refer to botanical specimens.

I have a small package of plants which Mr. Skillman will hand to you in the course of a few weeks. I have not collected any this year. But I have a number of duplicates yet remaining—which must remain in my collection for want of time to select them. . . . Dr. Short sends his compliments to you.⁹⁷

The other duties that had come to occupy Peter's time are verified in the following letter:

Lexington, April 21st, 1838

Dr. Robert Peter

Dear Sir

I am directed by the Board of Trustees of Transylvania University to inform you that on this day you were by a unanimous vote appointed Professor of Chemistry in the Medical College of the University, in the place of Dr. T. D. Mitchell appointed Professor of Materia Medica and Therapeutics. The Board hopes you will find no obstacle to an immediate acceptance of the appointment.

With great respect

Yours

Thos. A. Marshall, Chrmn.⁹⁸

Before leaving the consideration of Peter's botanical correspondence, two letters of importance are presented. As stated previously, one of the questions raised at the start of the investigation was: What was the link between Peter and Douglass Houghton, as suggested by the Houghton stamp on nearly all of the Peter specimens in The University of Michigan Herbarium? I found, with joy, in the archives of Transylvania University at Lexington the following letters from Houghton to Peter:

Detroit, Feb. 2, 1835

Dear Sir,

Yours of Jan. 5th came to hand in due time and I will assure you it is a pleasure to me that an avenue is now open by which we may from time to time correspond on the subjects nearest my heart.

Agreeably to your request I send you a catalogue of the plants which I was able to secure during my two years travels in the northwest. Of most of these I have duplicates—some of them in a fine state of preservation, others more imperfect—Were you acquainted with the difficulties which the only method of traveling in that section of country interposes you would not be astonished at the small number of plants collected, or at the injuries

which some of the specimens have sustained—We travelled almost wholly in bark canoes and these as a matter of course would from time to time become leaky and occasionally sink. I found the plants in several of my tin boxes, which I had supposed to be sealed so completely as to prevent any moisture reaching them, ruined. Those mentioned in the catalogue are those which were eventually saved.

A heavy pressure of business has thus far prevented me from making my scientific observations public, and in fact I have scarcely been able to examine the collections since my return—You will please return one of the catalogues I send you with such plants as you would wish marked. I will endeavour to send you a suit of them in the spring. I trust that I will be enabled to make some examinations in the country immediately surrounding in the coming season—as yet my botanical observations have not at the nearest point been less than at 500 miles from this place.

Accompanying the catalogue of plants which I send you is a catalogue of Minerals drawn up by Mr. Schoolcraft—other minerals were collected by myself and I have duplicates of them all—Mr. S. wished a catalogue for a work which he was then publishing and as my time would not permit me to make it he made use of my notes in drawing up the one which he published—I have rock specimens illustrative of all the formations from the sources of the Mississippi to the mouth of Fiebre River⁹⁹ (being about 1700 miles) as well as the coasts of Lks Erie, Huron, Michigan and Superior, also the country between Lk. Superior and the Mississippi and Lk. Michigan and the Mississippi.

I have also a fine collection of fresh water shells from the principal lakes of the interior—As I had no time to look to these upon our return and Mr. Schoolcraft wished a catalogue he sent a suit of them to Mr. Cooper of N. York, who made out a catalogue—I send you below a catalogue of them as made out by Mr. C.—I have duplicates of them all—My minerals and shells were by mistake forwarded to my former residence in N.Y. but I intend to order them back in the spring and will then be able to furnish several suits of perfect specimens.—In the immediate vicinity of this city we have but few minerals, in fact not any except Sulph. Strontian, which can be procured in any quantity from the Islands of Lk. Erie—Some two or three years ago I visited the farfamed Strontian Island of that Lk. The island is almost composed of that mineral.—¹⁰⁰

I am not at present prepared to send you a catalogue of my other plants from the western country but will endeavour to do so by and by—I lost nearly all my specimens of animals only three or four having been saved from a large collection—Among those lost there were several which I am satisfied are undescribed species—

The following list embraces I believe nearly all the fresh water shells I collected. I have no list by me at this moment and send them from recollection—

Unio cariosus	Unio alatus
" frustulosus	Symphysota inflata
" ventriculosus	" complanata
" tuberculatus	Palludina decisa
" plicatus	Physa heterotopha
" undatus	

This list although small embraces some shells interesting to the conchologist—

I will mark one of your catalogues and return it to you soon.

Should you have your eye on any plants in this section of country which you would like to have collected this ensuing summer, or should you wish any information of a scientific character which it is in my power [to] give, it would give me much pleasure to serve you, and although at present I am completely occupied in the arduous duties of my profession [medical], I hope eventually to be able to turn my attention more exclusively to the subjects of Nat. History. In the meantime I shall take much pleasure in continuing the correspondence which we have now commenced—

Yours truly

Douglass Houghton¹⁰¹

A second letter from Houghton to Peter, is dated Detroit, September 5, 1835:

In the fall of 1834, during severe family afflictions, I received through your kindness a truly valuable collection of Kentucky plants, & a collection which I will assure you I prize highly. This receipt of the plants was acknowledged soon after their reception by letter, but

in consequence of a train of circumstances which it would be difficult (& perhaps useless for me to attempt) to explain without a personal interview, it was impossible for me to make you a return at that time.

Circumstances had changed & I was nearly prepared to forward you a suit of northern plants, when Mr. Lapham, through whom you directed me to forward the plants, removed to Milwalkie [sic]. Soon after his removal I wrote you, to inform me through whom I should forward the plants, but as I have not received an answer I presume you did not receive my letter. Soon after writing you I left this city & was absent nearly a year. Since my return as I have been largely engaged in collecting plants I thought it better to defer writing you until I should be able to promise you a more choice suit.

The plants collected during this season have not yet been looked over & in fact my collectors have, as yet, sent in but few of them, but during the coming fall or early part of winter I will be able to select you a choice collection of western & northern plants, which will be forwarded through any channel you may direct.¹⁰²

Opportunities will occur to send them to New York, Philadelphia, Baltimore, Washington, or Pittsburgh, more frequently than to any other points & you will undoubtedly be able to receive them from some one of the points mentioned.

Will you please write me at as early a day as may be convenient; & in the mean time I trust you will not charge to want of good faith, what has been the result of a train of circumstances beyond my control.

Yours truly
D. Houghton¹⁰³

Houghton met a tragic death by drowning in October, 1845, off Eagle Harbor in Michigan's Upper Peninsula.

PETER'S HERBARIUM AND SPECIMENS

Peter's own herbarium, including specimens received from European botanists, was in afteryears given to the Kentucky State Agricultural and Mechanical College, later to become the University of Kentucky.¹⁰⁴

In 1924, Frank McFarland, demonstrating the value of the Peter Herbarium, wrote:

In the University of Kentucky Herbarium are 4,106 specimens, of which 3,157 were collected by Dr. Robert Peter and Dr. Charles W. Short of Lexington, from 1832 to about 1835. For the State, Dr. Peter has listed a total of 1,205 species, but only 470 mounted species are in the Herbarium. Only 592 species for the State are listed in the University of Kentucky Herbarium, with which the Peter Herbarium is consolidated, much fewer than the actual number in the State.¹⁰⁵

In 1958, Herbert Parkes Riley wrote:

Almost ten years ago the University of Kentucky had an herbarium of about 25,000 specimens. This collection was small but it was of some importance as it contained several thousand sheets that had been gathered in Kentucky over a hundred years before that date; many of them were not duplicated in other herbaria. Since Kentucky plants have not been studied extensively, any collection of Kentucky material is of interest and this collection, made by Dr. Short and Dr. Peter less than a hundred years after Kentucky was opened up to immigration, was quite valuable.¹⁰⁶

It is a matter of deep regret to students of the botany of Kentucky that these specimens were destroyed by the 1948 fire.¹⁰⁷

A small but valuable herbarium in the Department of Agronomy, College of Agriculture, University of Kentucky, contains a number of plants collected by Peter's son, Alfred Meredith Peter, over the years from 1877 to 1940. Many of these plants were taken from the same sites visited by Dr. Peter.¹⁰⁸

Of the herbaria assembled by the three associated Lexington collectors, only that of Short remains today, in a good state of preservation, at the Academy of Natural Sciences in Philadelphia (PH),^{108b} but Griswold's herbarium was destroyed by fire in 1837, and, as stated, Peter's in the same manner in 1948.¹⁰⁹

While a number of the specimens sent by Peter to Houghton survive at the University of Michigan Herbarium (MICH), any that Houghton may have exchanged with Peter apparently are lost.

Of Peter's exchanges, other than those at MICH, I have been able to locate some specimens: 108 at the Herbarium of the Philadelphia Academy of Natural Sciences (PH)¹¹⁰; four at the New York Botanical Garden (NY)¹¹¹; and ten at the United States National Arboretum (NA),^{112, 112b} all of these recorded by Ronald Stuckey¹¹³ and added to the list in Appendix B. A few were found at the Jardin Botanique National de Belgique, Meise (BR)¹¹⁴, and at the Arnold Arboretum and Gray Herbarium at Harvard University (A and GH).¹¹⁵ Clokie recorded seven specimens from Lexington, Kentucky, at "Oxford (OXF), all O.F.C. (P)."¹¹⁶ I did not query further there. "R. Peter" is listed in the Index to Collectors in the Edinburgh Herbarium (E),¹¹⁷ but only one Peter specimen was found in 1993, and that on loan from Glasgow University.¹¹⁸ James P. O'Connor, of the National Museum of Ireland, referred my query to the Herbarium, Irish National Botanic Gardens, Glasnevin, Dublin (DBN), to which the National Museum Botanical Collections had been removed in the 1970's.¹¹⁹ Howard F. Fox, Botanist at DBN, sent a careful answer, including photocopies of sources, one of which named R. Peter as a collector represented there.¹²⁰ Mr. Fox was unable to expand upon that information.¹²¹

One "A. M. Peter" specimen, *Gymnocladus dioica*, was reported from the United States National Herbarium (US), collected in 1877,¹²² and Vegter¹²³ reported some of his at NY.

No Robert Peter specimens were found at the herbarium of Angers (ANGUC)¹²⁴; the Carnegie Museum of Natural History (CM), Pittsburgh¹²⁵; the Cleveland Museum of Natural History (CLM)¹²⁶; the Dayton, Ohio, Museum of Natural History (DNMH)¹²⁷; the Rijksherbarium at Leiden (L)¹²⁸; the University of Glasgow (GL)¹²⁹; the University of North Carolina, Wilmington (WNC)¹³⁰; the University of Southwestern Louisiana (LAF)¹³¹; and West Chester University, Pennsylvania.¹³² I had queried these herbaria as likely places for the deposit of Peter's specimens sent to various collectors.

Regarding Peter specimens sent to Charles Parker, Liverpool, Angus Gunn replied from the Merseyside County Museums, "I am unable to ascertain whether or not we have any specimens from Robert Peter or Charles Wilkins Short.

"Many of our specimens that were collected in the early nineteenth century had their original labels replaced at some later date and these replacement labels often contain little information. . . . The only collector that appears to be associated with our Parker specimens is Elliott about whom we know only that his plants came from New Jersey."¹³³

Hildreth's herbarium is no longer extant.¹³⁴ Durand's herbarium, including Rafinesque specimens and doubtless some of Peter's, was deposited at the Museum National d'Histoire Naturelle, Paris (P),¹³⁵ but a letter sent there in 1992 met with no response.

In most of the herbaria listed above, computerization of collection data has not been completed, making an answer to my queries not reasonable without a personal visit and search.

A query to the Herbarium of the Royal Botanic Gardens, Kew (K), produced a particularly interesting answer. Archivist Cheryl Piggott wrote that it appeared likely that Kew does hold some of Peter's specimens but that one could only search via plant name, checking for a collector's name or initials. She wrote:

Peter certainly sent specimens to Sir William Hooker, then Professor of Botany at the University of Glasgow. In a letter dated 17 October 1836 (copy enclosed, the only Peter letter in Kew's archives) he says he sent 400 specimens of Kentucky plants to Hooker in the spring of 1836. Hooker has written at the top of the letter, 'Promise more specimens in future, in return for these 400 species, for which I cannot find a customer. . . ' That Hooker eventually found a customer seems unlikely, because it is recorded in the Kew Bulletin of Misc Information of 1901 that 400 specimens of North America plants collected by Peter were received at the Kew herbarium in 1848. The date is rather puzzling, though it is repeated in *Index Herbariorum*, Pt. II. So there were Peter specimens here, though the Bulletin warns that there is no way of knowing whether the collections have remained at Kew or whether they might have been exchanged or presented to other herbaria.¹³⁶

I quote here the "only Peter letter in Kew's archives."

Lexington Ky. Oct. 17, 1836

Dear Sir,

Your very valuable present of Books and specimens reached me some months ago after very great delay and no little exposure in the Custom house in this country. They, however arrived here safely, and lay upon me such a weight of obligation to you as I fear I shall not shortly remove. I need not tell you that I thank you for your magnificent present, thanks are but a small return for it. Yet I fear that I cannot shortly return any thing much more substantial, as I am obliged to confess that the press of other *business* occupations has, during the past season, entirely (almost) prevented me from giving my attention to the collection of Botanical specimens, or objects of Natural History—The past season has been almost a blank to me in Botany or in Natural History. But I think that I can promise that it will not be so always and that I may yet promise myself the pleasure of contributing some specimens to your sons' ornithological cabinet, and perchance to your herbarium. With such an able purveyor, however, as our friend Dr. Short, you have not much to expect from me, in the way of Botany, nor to lose, should I turn my labours in another channel.

This spring I took the liberty of sending to your care a box of 400 specimens of Kentucky plants, which, as Dr. Short no doubt requested you, you will please dispose of as you may think proper. If not too late I must request you to select from it any thing that may be acceptable to you.—I hope also that the few bird's skins which I was able to get together were acceptable to your son.

I sent at the same time a small package to our friend C. S. Parker which I hope has arrived in safety.—I wrote to him in April last but as I addressed C. L. Parker, Liverpool, I fear my letter has miscarried—indeed the package was also thus improperly directed. Will you be so good when you next communicate with him to mention these circumstances.

With sentiments of gratitude

and respect

I remain

Robt. Peter¹³⁷

W. J. Hooker L.L.D.

A further goal of this investigation was to expand the knowledge of Peter's collecting localities, correlating his notations with present-day landmarks. A great help was the list appended to Peter's "Catalogue" by his son, Alfred.¹³⁸ Some data were generously supplied by Dr. Ronald Stuckey. More information was gleaned by comparison of label data on the specimens with notes in the "Catalogue," assiduous study of topographical and road maps (listed in the References), reading Peter's *History of Fayette County*, and from fragments of explanation scattered throughout other sources. Nothing was learned of the Pittsburgh collecting sites.

A list of the collecting localities in Kentucky, giving as much elucidation as possible, has been included as Appendix A.

I have had to conclude researches at this point, without following every possible lead. It is probable, because of Peter's wide acquaintance and correspondence, that many other facts significant to his botanical pursuits will come to light.

Although Robert Peter's botanical contributions were relatively few, their high quality has made any surviving specimens additionally valuable.

ACKNOWLEDGMENTS

Dr. Rogers McVaugh of the Department of Biology, University of North Carolina, and formerly of the University of Michigan Herbarium suggested the project; I am especially indebted to him for his guidance and encouragement throughout the work. Also, I particularly thank Dr. Edward Voss of the University of Michigan Herbarium, Dr. Ronald Stuckey of the Ohio State University Herbarium, and Dr. Larry Morse of The Nature Conservancy, Virginia Chapter, for their counsel and advice, and for generously sharing with me research materials. A National Science Foundation COSIP grant to Eastern Michigan University made possible a week's study at Lexington and Louisville in 1974. The research facilities of the University of Michigan Herbarium were made available to me, as a Research Associate, from 1973 to 1978, and intermittently since then. I am also grateful to the many persons who helped me in locating information or answered my letters regarding certain records.

APPENDIX A

COLLECTING LOCALITIES OF ROBERT PETER

Big Hill [Bighill]: Present-day intersection of KY-31 and US-421, about 8 miles east of Berea, Madison County. Ca. 37°16'N, 84°11'W.

Big Spring: Deep sinkhole on Peter's farm (Winton) 6 1/2 miles north of Lexington; east off Newtown Pike (KY-922) between Iron Works Pike and Lemons Mill Pike, Fayette County. 38°09'15"N, 84°28'30"W.

Blue Lick: Blue Licks Battlefield State Park, 23 miles northeast of Paris, in bend of Licking River, Nicholas County. 38°25'45"N, 83°59'00"W.

Boone County: County bordering Ohio River below (southwest) of Cincinnati. Ca. 39°00'N, 84°45'W.

Boonsborough [Boonesborough]: Kentucky River at crossing of present-day US-227 and near Fort Boonesborough State Park, Madison County. 37°54'30"N, 84°16'15"W.

Boon's [Boone's] *Creek*: At the Kentucky River, border of Clark and Fayette Counties. 37°53'30"N, 84°20'15"W.

Carrington's Peak: (See Olympian Springs) A knob near the Olympian Springs, along KY-36, Bath County. 38°03'30"N, 83°40'15"W.

Clay's Ferry: Across Kentucky River near present-day I-75, between Fayette and Madison counties. 37°53'00"N, 84°20'30"W.

College Lot: Present Gratz Park, downtown Lexington; bounded by Third, Market, Second, and Mill Streets. 38°03'00"N, 84°29'45"W.

Combs' Ferry: Vicinity of Lisletown, off Combs' Ferry Road, Kentucky River, Clark/Madison Counties. 37°55'00"N, 84°16'30"W.

Courthouse Yard: Downtown Lexington, Fayette County. 38°03'00"N, 84°29'45"W.

Crab Orchard: A village near the eastern border of Lincoln County, on the Cumberland Gap Road and near the headwaters of Dix River; today on US-150 between Danville and Mount Vernon. 37°28'00"N, 84°30'30"W.

Cumberland and Barren Rivers, Kentucky: ?

Dry Ridge: Present-day KY-22 and US-25, on road to Cincinnati, Grant County. 38°41'00"N, 84°35'15"W.

Elkhorn Creek: The several branches of Elkhorn Creek encompass Lexington. The North Branch arises in Fayette County, east of Lexington, and loops north, then west around the city. The Town Branch, now partially buried under the University of Kentucky campus, flows northwest out of the city, joining the South Branch at the border of Woodford and Scott Counties. The South Branch, originating in Fayette and northern Nicholas counties, curves about Lexington in the southwest and west. The community of South Elkhorn lies 5 miles southwest of Lexington at the intersection of the creek and US-68. The Forks of the Elkhorn join in eastern Franklin

- County near US-460. The joined forks empty into the Kentucky River in northern Franklin County, and the Kentucky River, in turn, joins the Ohio River in Carroll County.
- Elkhorn on the Maysville Road*: Elkhorn Creek, North Branch, at the present-day Paris Pike, 8.2 miles northeast of the center of Lexington, Fayette County. 38°06'30"N, 84°24'30"W.
- Elkhorn Creek three miles below Lexington*: South Elkhorn, US-68 at Elkhorn Creek, Fayette County. 37°59'45"N, 84°35'00"W.
- Forks of Elkhorn*: Just northeast of Frankfort on US-460, Franklin County. Ca. 38°12'N, 84°48'W.
- Elk Lick*: Creek joining Kentucky River, Mile 168, 2 miles northwest of intersection of the river with I-75, Fayette/Madison counties. 37°53'55"N, 84°22'00"W.
- Elk Run*: Same as Elk Lick.
- Forge on Red River near Irvine*: On the Red River, then within the boundaries of Estill County, near the mouth of Hardwick's Creek in the vicinity of Clay City, Powell County. 37°50'00"N, 83°55'30"W.
- Fowler's Garden*: 5 or 6 miles northwest of Lexington on the old railroad, in 1942 the L&N to Frankfort and Louisville; present-day vicinity of Bracktown or National Institute of Mental Health, Fayette County. Ca. 38°06'N, 84°34'W.
- Frankfort*: 24 miles northwest of Lexington, Franklin County. Ca. 38°12'N, 84°49'W.
- Frankfort, marsh 12 miles on road to*: About 12 miles northwest of Lexington, along Old Frankfort Pike, vicinity of Nugents Cross Roads, Woodford County. 38°10'30"N, 84°45'00"W.
- Gratz Park*: Downtown Lexington, bounded by Third, Market, Second, and Mill Streets. 38°03'00"N, 84°29'45"W.
- Greenfield*: (If given as collection site) Birthplace of Charles Wilkins Short, pioneer residence of his parents, comprising several thousand acres of gently rolling, fertile, inner Blue Grass land on the North Fork of Clear Creek, just south of Versailles, Woodford County. 38°00'00"N, 84°43'00"W.
- Hickman's Creek*: Entering Kentucky River near present US-27, Jessamine County. 37°46'15"N, 84°36'45"W.
- Indian Creek*: Blue Licks Battlefield State Park, 23 miles northeast of Paris, in bend of Licking River, Nicholas County. 38°25'45"N, 83°59'00"W.
- Irvine*: Present-day KY-89 and KY-52, Estill County. 37°42'00"N, 83°58'30"W.
- Kentucky River*: The Kentucky River forms a large, V-shaped loop about 14 miles south of Lexington, setting off, in part, boundaries of Mercer, Woodford, Jessamine, Madison, and Fayette counties. Peter did much collecting along this river, at such places as Rodgers', Elk Lick, Boone's Creek, Raven Creek, Shaker Ferry, etc. If no more precise locality can be determined, a very rough 37°52–55'N, 84°15–22'W may be used.
- Lewis' Ferry*: Kentucky River, 1 1/2 miles east of Shakertown, just downriver from present-day High Bridge and mouth of Dix River, Jessamine/Mercer counties. (Same as Upper Shaker Ferry.) 37°49'15"N, 84°43'30"W.
- Lexington*: Lexington, Fayette County. The downtown area and general vicinity of the city may be designated ca. 38°03'N, 84°30'W. City limits in 1832 were 1 mile from the Courthouse in all directions.
- Licking River*: A tributary of the Ohio River, the Licking River flows past the Blue Licks Battlefield, which is probably the place at which Peter collected; Nicholas County. 38°25'45"N, 83°59'00"W.
- Masterson's Meadow*: North side of the Richmond Road (KY-418) just beyond the old city limits; about 1 mile from downtown Lexington. Fayette County. Present-day US-25/US-421, about the site of the Idle Hour Country Club. 38°01'30"N, 84°28'30"W.
- Mud Lick*: Another name for the Olympian Springs but there were other Mud Licks (A. M. Peter, 1942). See also North Bend.
- Muddy Creek*: At Shorthill, estate of John Cleves Short at Big Bend, Cincinnati, Hamilton County, Ohio. (See Short and Eaton, 1831, p. 70, for description of trip to Cincinnati.) Ca. 39°08'00"N, 84°45'00"W.
- New Jersey*: Mary Henry Churchill, daughter of Jane Henry Churchill Short (stepmother of Charles) came from New Jersey in 1804, with her grandmother. She returned to her uncle's home in New Jersey one year after the death of her mother. She married C. W. Short in 1815. This connection may be the source of the New Jersey plants.
- North Bend*: North Bend of the Ohio River at Cincinnati. "Shorthill," home of John Cleves Short, was described as lying 12 miles south of Cincinnati on the banks of the Ohio River. The present-day communities of North Bend and Cleves lie 12 miles west, or downstream, of Cincinnati. Three miles upstream from North Bend is a "Shorts Woods," and about 4 miles downstream Mud Lick Creek empties into the Whitewater River just above the Ohio. Hamilton County, Ohio. Ca. 39°08'N, 84°45'W.

Ohio River: Very likely in the vicinity of North Bend.

Old Race Track: See Race Track.

Olympian Springs: Present KY-36 between Owingsville and Frenchburg, Bath County. 38°03'30"N, 83°40'15"W.

Paper Mill on Wolf Run near Woodford Road: Present-day Wolf Run at New Circle Road, Lexington, Fayette County. 38°03'30"N, 84°33'00"W.

Mr. Peck's Garden: Probably on the north side of Short Street, facing Cheapside, Lexington, Fayette County. 38°03'00"N, 84°29'45"W.

Mr. Peers' Garden: "No. 437 W. Second Street is the building occupied by Peers' Eclectic Institute, a girls' School of Rev. Benjamin O. Peers. It was in a large lot. The Hagerman Apartment on the east and the Howard Apartment on the west, recent buildings, are on the Peers lot. The garden presumably was in the back of the lot" (A. M. Peter, 1942). Downtown Lexington, Fayette County. 38°03'15"N, 84°29'30"W.

Race Track (1834): Probably the Williams Race Track, situated in 1825 near the present Kentucky Central R.R. freight depot, Scott Street and South Broadway, Lexington, Fayette County (only a few blocks from the Red Mile). 38°02'30"N, 84°30'45"W.

Raven Creek: Raven creek at the Kentucky River, Mile 166/167, off Jacks Creek and Kiddville Roads, Fayette County. 37°53'30"N, 84°23'00"W.

Red River: Probably where KY-89 crosses the Red River, about 7 miles north of Irvine, Clark/Estill Counties. 37°49'30"N, 84°04'00"W.

Red River near Winchester, Kentucky: Unknown.

Richmond: Present-day city on I-75 about 5 miles south of the Kentucky River, Madison County. 37°45'00"N, 84°18'00"W.

Rogers' [Rodgers], Richmond road: Vicinity of present-day US-421 at the Kentucky River, Fayette County. 37°54'N, 84°22'W.

Shaker Ferry, lower: Kentucky River, about 5 miles northeast of Shakertown, crossing of KY-33/US-68 at Brooklyn Bridge, Jessamine/Mercer Counties. 37°51'45"N, 84°42'00"W.

Shaker Ferry, upper: Kentucky River, 1 1/2 miles east of Shakertown, just downriver from present-day High Bridge and mouth of Dix River, Jessamine/Mercer Counties. (Same as Lewis' Ferry.) 37°49'15"N, 84°43'30"W.

Shorthill: (If given as collection site) Estate of John Cleves Short, brother of Charles Wilkins Short, on the bank of the Ohio River, 12 miles below Cincinnati; see also North Bend. Hamilton County, Ohio. Ca. 29°08'N, 84°45'W.

Dr. Short's Garden: Northeast corner of Market and Second Streets, downtown Lexington, Fayette County. 38°03'00"N, 84°30'45"W.

Short's Woods: In Cincinnati, Ohio, the 32 acres of "Shorts Woods" extend north from Fernbank Avenue between Dahlia and Catalpa Avenues.

Stoner's [Stoner] Creek: On Maysville Road, present US-68, in Paris, Bourbon County. 38°12'45"N, 84°14'50"W.

Sublett's Ferry: Probably Clifton Pike (KY-326) at the Kentucky River, about 6 miles west of Versailles, Anderson/Woodford counties. Ca. 38°03'N, 84°50'W.

Sweet Lick Knob, Irvine: Present-day KY-89 and KY-52, Estill County. 37°42'30"N, 83°59'00"W.

Col. Taylor's: Unknown.

Versailles: Versailles, on US-62, Woodford County. 38°03'00"N, 84°44'00"W.

Warfield's "Meadows": In 1884 R. Peter wrote: "J. H. Talbutt's farm ('The Meadows') late Warfield's; half a mile northeast of Lexington." Approximately the intersection of present-day US-27/US-68 and US-75/US-64. Ca. 38°05'N, 84°28'W.

Warfield's Woods: North side of the Winchester Road (US-60) a short distance east of Lexington, Fayette County. 38°02'30"N, 84°27'30"W.

Williams' Thicket: Probably vicinity of old race track, near the present Kentucky Central R.R. freight depot, Scott Street and South Broadway, Lexington, Fayette County. 38°02'30"N, 84°30'45"W.

Winchester: Winchester, US-60 at KY-15 and KY-89, Clark County. 37°59'30"N, 84°10'45"W.

Winslow's Thicket: On the east side of present Rose Street, probably on the branch of Elkhorn Creek, which now is underground through the University of Kentucky campus, downtown Lexington, Fayette County. 38°02'00"N, 84°30'15"W.

Winslow's Woods: East of the present University of Kentucky campus, downtown Lexington, Fayette County. Ca. 38°01'30"N, 84°29'30"W.

Winton: 6 1/2 miles north of Lexington; east off Newtown Pike (KY-922) between Iron Works Pike and Lemons Mill Pike, Fayette County. Ancestral home of Frances Dallam Peter, which became the home of Robert Peter and his family after the Civil War. 38°09'15"N, 84°28'30"W.

Wolf's run: The present-day town of Wolf Run is near the intersection of Old Frankfort Pike and New Circle Road. Wolf Run, a tributary of the Town Branch of Elkhorn Creek, runs near here. Presumably the site meant is near the intersection of Old Frankfort Road and Wolf Run. 38°04'00"N, 84°33'00"W.

Woodford Road, creek near: Probably intersection of Wolf Run and road to Versailles, US-60, Fayette County. Ca. 38°08'N, 84°33'W.

APPENDIX B

BOTANICAL COLLECTIONS OF ROBERT PETER

A total of 384 Peter specimens, 279 of which belong to The University of Michigan Herbarium (MICH), were located during this study and annotated; a sample label is shown in Fig. 5. An annotated list of these plants follows below. All specimens came from within the boundaries of Kentucky unless otherwise specified.

The name in italics is that under which the specimen was filed. Material within quotation marks is transcribed from Peter's labels. All information supplied by me as a result of this research is included in brackets. Expansions of habitat data come chiefly from Peter's "Catalogue." Specimens found in herbaria other than MICH are indicated by standard herbarium abbreviations (Holmgren et al., 1981). Absence of herbarium designation indicates MICH.

"C/P" followed by a number refers to an entry in Peter's manuscript "Catalogue of Plants." As Peter often collected several plants under one number, arbitrary letter designations are inserted, e.g., "C/P 742(e)." Notes initialed "R. S." are by Ronald Stuckey.

Information on specimens in the United States National Arboretum (NA) was supplied by Frederick G. Meyer and Susanne Elsasser. Peter's specimens came to NA via Douglass Houghton, Zina Pitcher, and the Isaac C. Martindale Herbarium. Label data from specimens at the Philadelphia Academy of Natural Sciences (PH) and the New York Botanical Garden (NY) were recorded by Ronald Stuckey. At PH, some specimens had originally belonged to the Thomas C. Porter or Short herbaria, but the majority were apparently sent directly to the Philadelphia Academy by Peter.

PTERIDOPHYTA

OSMUNDACEAE

Osmunda regalis L.—"Osmunda regalis Licking river [probably Blue Lick] May [1833] by C. Peck" [C/P 511]

POLYPODIACEAE

Asplenium angustifolium Michx. [Now *Athyrium pycnocarpon* (Spreng.) Tidestrom] —"Asplenium angustifolium Kentucky D. Houghton R. Peter, M.D." [cf. C/P 890(c) Rodgers' August/September 1835] [Isaac C. Martindale Herbarium, NA]

Asplenium platyneuron (L.) Oakes —"Asplenium ruta muraria L. On rocks, cliffs [Boone's Creek, Rodgers'], Kentucky river May [25] 1833." [C/P 474(c)]

Athyrium pycnocarpon (Spreng.) Tidestrom —"Asplenium angustifolium Wooded alluvial flat, [Elk Lick], Kent[uck]y river Aug[ust 16] 1834." [C/P 812 1/2 (c)]

Athyrium thelypteroides (Michx.) Desv.—"Asplenium thelypteroides Michx. Wood, hill side, on Ohio river [probably North Bend, Cincinnati] Sept[ember] 1833." [C/P –]

Cystopteris fragilis (L.) Bernh.—"Aspidium tenue Woods, banks of Kent[uck]y river [near Rodgers', at the Richmond Road] June [21] 1834." [C/P 789(n)]

Pellaea atropurpurea (L.) Link —"Pteris atropurpurea On rocky cliffs, Kentucky river [probably Fayette Co.] Aug[ust] 1834." [C/P –]

Phegopteris hexagonoptera (Michx.) Fee —"Polypodium hexagonopterum Woods, rocky places Sep[tembe]r 1833" [Phegopteris hexagonoptera (in pencil on sheet)] [C/P –] —"Polypodium dryopteris Woods, Crab orchard [Lincoln Co.], K[entuck]y Aug[ust 2–3] 1835." [C/P 862] [(Short Herbarium) PH]

PLANTS OF KENTUCKY

Collected by Robert Peter, M.D., 1833–1835

Ceanothus americanus L.

Rhamnaceae

21 June 1834 Cliffs, near Rogers', Kentucky
River at the Richmond Rd., Fayette Co.
37° 54' N; 84° 22' W.

Peter's manuscript "Catalogue of Plants of Kentucky" (nos. 566–935) is preserved in the archives of the University of Kentucky, at Lexington. Individual catalogue numbers often pertain to several plants collected at the same time and place.

The specimens at the University of Michigan originally formed a part of the herbarium of Douglass Houghton (See *Michigan Botanist*, vol. 9, p. 223, 1970).

Apparently this specimen, or a duplicate of it, was collected under catalogue no. 789[c].

FIG. 5. Label with data resulting from this study of Peter's collections affixed to a specimen of *Ceanothus americanus* L. at MICH; see also Fig. 1.

Polypodium polypodioides (L.) Hitchcock —"Polypodium incanum On moss-covered limbs of trees [sandy beach at Boonsborough] Aug[ust 8–9] 1834." [C/P 812(p)] —"Polypodium incanum On the bark of the branches of trees - Kent[ucky] Sept[ember] 1834 [? R. S.]" Second label, "Polypodium incanum Willd. Kentucky. Prof. Peter for Mr. Durand." [Thomas C. Porter Herbarium, PH] [C/P –]

Woodsia obtusa (Spreng.) Torr.—"Hypopeltis obtusa ? (~~Aspid. obtusum~~) Rocks [shady flat] near Kentucky river [near Rodgers' at the Richmond Road] June [21] 1834." [C/P 790(a)]

SPERMATOPHYTA

ANGIOSPERMAE–MONOCOTYLEDONAE

POTAMOGETONACEAE

Potamogeton foliosus Raf. var. *foliosus* —"Potamogeton compressus–parviflorus Brook [Wolf's Run] near Lex[ing-to]n July [2] 1834." [C/P 795(a)] Second specimen [n.d.], probably as above [PH]

Potamogeton natans L.—"Potamogeton natans, Kent[ucky] river June 1834." [C/P ?] {Annotated "B.H. 195/6 Potamogeton Lucens, Linn," "J M C," and "P. Lonchites, Tuckerman! A.B."} [GL]

Potamogeton natans L. var. *prolixus* Koch —"Potamogeton natans Kentucky river [near Rodgers' at the Richmond Road] June [21] 1834." [C/P 790(f)]

Potamogeton nodosus Poir.—"Potamogeton natans Kentucky river [probably near Rodgers'] July 1834." [PH] [C/P –]

ALISMATACEAE

Sagittaria latifolia Willd. f. *obtusa* (Muhl.) Robinson —"Sagittaria obtusa Wet, Banks, Kent[ucky] river [lagoon near Raven Creek] Aug[ust 23], 1834." [C/P 815(a)]

HYDROCHARITACEAE

Elodea canadensis Michx.—"Serpicula canadensis In a lagoon, Banks of Kent[ucky] river [below Raven Creek] Aug[ust 23] 1834." [C/P 815(e)]

GRAMINEAE

Agrostis alba L.—"Agrostis dispar ? (Mx.) Side of brook, Lexington July [2] 1834." [C/P 795]

- Agrostis hyemalis* (Walt.) B. S. P.—“*Trichodium laxiflorum* Sandy banks, Kentucky River [near Rodgers'] Aug[ust 16] 1834.” [C/P 812 1/2 (e)]
- Andropogon scoparius* Michx.—“*Andropogon scoparium* Rocky bank [cliff, Boonsborough], Kent[uck]y river Aug[ust 8–9] 1834.” [C/P 812(n)] —“*Andropogon purpurascens scoparius* Bank [Raven Creek], Kent[uck]y river Aug[ust 23] 1834.” [C/P 814(b)]
- Arrhenatherum elatius* (L.) Beauv.—“*Arrhenatherum Kentuckiensis* avenaceum [?] Grass plot, court-house yard, Lexington May [26] 1834.” [C/P 768(a)] 2 specimens
- Dactylis glomerata* L.—“*Dactylis glomerata* L. Grass plot [College lot], Lexington June 1833.” [C/P 534]
- Danthonia spicata* (L.) Beauv.—“*Danthonia spicata* Dry roadside, [Richmond Road near] Kent[ucky] river, [Madison Co.] June [1] 1834.” [C/P 781(c)]
- Elymus villosus* Muhl.—“*Elymus villosus* Thickets [near Rodgers'] June [21] 1834.” [C/P 789(h)]
- Elymus virginicus* L.—“*Elymus virginicus* L. Thickets, etc. [vicinity of Lexington] June 1834.” [C/P –]
- Eragrostis hypnoides* (Lam.) B. S. P.—“*Poa reptans* Sandy shore, Kentucky river [probably Fayette Co.] Aug[ust] 1833.” [C/P –]
- Eragrostis pectinacea* (Michx.) Nees —“*Poa pectinacea* Sandy beach Kent[uck]y river, Boonsborough Aug[ust 8–9] 1834.” [C/P 812(j)] [Thomas C. Porter Herbarium, PH]
- Glyceria fluitans* (L.) R. Br.—“*Glyceria fluitans* Wet flat on Red river [probably near forge, Powell Co.], K[entuck]y. June [2] 1834.” [C/P 774(a)]
- Glyceria nervata* (Willd.) Trin.—“*Poa nervata* Wet places, Lexington June [21] 1834.” [C/P 793]
- Hystrix patula* Moench.—“*Elymus hystrix* [Top of] cliff, [upper Shaker's ferry] Kentucky river June [5] 1834.” [C/P 789(d)]
- Leersia oryzoides* (L.) Sw.—“*Leersia oryzoides* Wet places, Lex[ingto]n July [13] 1833.” [C/P 594] —“*Leersia oryzoides* Banks of Kentucky river [near Raven Creek] Aug[ust 23] 1834.” [C/P 814(i)] [Thomas C. Porter Herbarium, PH]
- Leersia virginica* Willd.—“*Leersia virginica* Damp places [Raven Creek] Aug[ust 23] 1834.” [C/P 814(h)]
- Leptochloa filiformis* (Lam.) Beauv.—“*Oxydenia attenuata* (Nutt.) Old cultivated field near Ken[tuck]y river [near mouth of Elk Lick] Sept[ember 20] 1834.” [C/P 816(d)]
- Melica mutica* Walt.—“*Melica diffusa* ? ~~Pursh~~ [Shaker ferry], Kent[uck]y river No. 767 May [19] 1834.” [C/P 767(a)] —“*Melica (speciosa)* Cliffs [Shaker ferry] Kent[uck]y river May [19] 1834.” [C/P 766 1/2 (b)] —“*Melica speciosa* Cliffs [Upper Shaker ferry] Kent[uck]y river May [23] 1835.” [C/P 829(j)] [PH]
- Melica striata* (Michx.) Hitchc.—“*Bromus* ? No. 766 [Shaker ferry, Kentucky river] May [19] 1834.” [C/P 766]
- Panicum capillare* L.—“*Panicum capillare* Damp places [meadows and swampy], Lex[ingto]n July 1833.” [C/P 494]
- Panicum commutatum* Schultes —“*Panicum latifolium* Meadow etc. [probably Rodgers'] June [May 25 1833].” [C/P 469]
- Panicum dichotomiflorum* Michx.—“*Panicum geniculatum* var. *proliferum* Lam. Alluvial banks, Kent[uck]y river [probably Fayette Co.] Sept[ember] 1834.” [2 specimens] [C/P –]
- Panicum lindheimeri* Nash var. *fasciculatum* —“*Panicum nitidum* var. *pilosum* [Masterson's] Meadow near Lex[ingto]n June [16] 1835.” Annotated: “*P. huachucae* Ashe var. *silvicola* Hitchc. & Chase - det. Hitchcock & Chase.” [C/P 836(d)]
- Panicum virgatum* L.—“*Panicum virgatum* Rocky banks, Kent[uck]y river [Boonsborough] Aug[ust 8–9] 1834.” [C/P 812(o)]
- Paspalum mucronatum* Muhl.—“*Ceresia fluitans* Wet places near Lex[ingto]n June 1834.” [C/P –] [2 specimens]
- Paspalum pubescens* Muhl. [Agnes Chase (R. S.)] —“*Paspalum dasyphyllum* (Elliott) Meadow, near Lex[ingto]n July [14] 1835.” [C/P 847(z)] [PH]
- Poa brachyphylla* Schultes —“*Poa brevifolia* Muhl. Woods [hillside near Rodgers'], Kent[uck]y river [April 5] 1834.” [C/P 724(a)] [2 specimens]
- Poa sylvestris* Gray —“*Koeleria pennsylvanica* ? Woods, cliffs [and hillside, upper Shaker ferry], Kent[uck]y river May [23] 1835.” [C/P 824(a)] [PH]
- Sorghastrum nutans* (L.) Nash —“*Andropogon ciliatum* Rocky bank, [Raven Creek], Kent[uck]y river Aug[ust 23] 1834.” [C/P 814(c)]

- Sphenopholis nitida* (Spreng.) Scribn.—“Koeleria ? No. 758 Hill side, [woods] Kent[uck]y river, [Rodgers'] May [20] 1834.” [C/P 758(a)]
- Sporobolus vaginaeflorus* (Torr.) Wood —“Agrostis clandestina Dry ridge [road to Cincinnati, Grant Co.] Sep[tembe]r [28] 1833.” [C/P 690(a)]
- Tridens flavus* (L.) Hitch.—“Tricuspid seslerioides Rocky banks, Kent[uck]y river, [probably near Rodgers'] Sept[ember] 1834.” [C/P –]
- Uniola latifolia* Michx.—“Uniola latifolia Damp soils, Boone Co. No. 415 [Pittsburgh number ?] June 27 1834.” [C/P –]
- Uniola laxa* (L.) B. S. P.—“Festuca ? (654) Marshy flats of Red river, K[entuck]y.” [In C/P, entry No. 654 reads: “Festuca (crossed out) Uniola gracilis Mx. ? Mr. Griswold. Marshy flats of Red river. [n.d.]” [PH]

CYPERACEAE

- Carex albursina* Sheldon —“Carex anceps ? Hill side [woods], Kent[uck]y river [Rodgers'] May [10] 1834.” [C/P 752]
- Carex eburnea* Boott —“Carex alba ? Dry cliffs, Shaker ferry, Kent[uck]y river July 1834.” [C/P –]
- Carex frankii* Kunth.—“Carex ? No. 773 Wet meadow June [2] 1834.” [In C/P, No. 773 is *squarrosa*, Torrey] [Annotated: “(young material)” “Carex typhina Schwein. 5/38 Det. by F. J. Hermann”] [Herb. of E. C. Almendinger, Ann Arbor, Mich., presented by G. F. Almendinger] [C/P 773] —“Carex sparganoides ? Wet places [An earlier specimen was recorded in Peter's Catalog as No. 755, on rocky banks of shadey brook, Rogers', Kentucky River at the Richmond Road.] July 1834.” [C/P –]
- Carex hitchcockiana* Lam.—“Carex ? No. 754 Shady banks of brook near K[entuck]y river [Rodgers'] May [20] 1834.” [C/P 754]
- Carex laevivaginata* (Kukenth.) Mack.—“Carex ? No. 758” [5/38 Det. by F. J. Hermann] [C/P –]
- Carex pennsylvanica* Lam.—“Carex marginata ? Woods, hill side near Kentucky river [Rodgers'] April [5] 1834.” [C/P 723(a)]
- Carex retroflexus* —“Carex retroflexus ? Shadey banks of creek, on rocks. [Probably vicinity of Kentucky River] May 1834.” [C/P –]
- Carex shortii* Torr. “Carex shortiana Dewey K.M.” —“No. 762 Carex ? ‘Shortii Torr. n. sp. [Torrey's writing on label in ink, R. S.]’ [Creek near Woodford Road (C/P 762), west of Lexington, Fayette or Woodford Cos.] June 1834 [Date in C/P is May 16 1834; this may have been a later collection from the same locality].” (Torrey Herbarium, NY)
- Carex squarrosa* L.—“Carex squarrosa ? No. 779 Wet meadow near Richmond K[entuck]y June [1] 1834” [C/P 779]
- Carex* sp.—“Carex ? No. 755 Rocky bank of creek [shadey brook, Rodgers'] at Kent[uck]y river May [20] 1834.” [C/P 755]
- Carex* sp.—“Carex ? No. 772 Wet meadow [near Red River, probably near forge, Powell Co.] June [2] 1834.” [C/P 772]
- Carex* sp.—“Carex ? No. 781 Wet meadow [between Clay's ferry and Richmond, Madison Co.] June [1] 1834.” [C/P 781]
- Cyperus aristatus* Rottb.—“Cyperus inflexus Sandy beach, Kent[uck]y river [Rodgers'] Sep[tembe]r 1834.” [C/P –]
- Cyperus flavescens* L.—“Cyperus flavescens Wet places, Lex[ingto]n July [20] 1833.” [C/P 607]
- Scirpus atrovirens* Muhl.—“Scirpus atrovirens Wet places, Lex[ingto]n June 1834.” [C/P –]
- Scirpus lineatus* Michx.—“Scirpus eriophorum Wet places, Lex[ingto]n June 1834.” [C/P –]

COMMELINACEAE

- Commelina diffusa* Burm.—“Commelina communis Damp, near Lex[ingto]n Aug[ust] 1833.” [C/P 660] [PH] —“Commelina communis Damp places near Lex[ingto]n, [marsh 12 miles on road to Frankfort, Woodford Co.] Oct[ober] 1834 [Note: probably September 30, 1834].” [C/P 819(g)]

PONTEDERIACEAE

- Heteranthera reniformis* R. & P.—“Heteranthera reniformis Marshy pond 12 miles from Lex[ingto]n, [on road to Frankfort, Woodford Co.] Sep[tembe]r [3] 1834.” [2 specimens] [C/P 819(a)] [Also 1 specimen at PH]

Heteranthera sp. —“*Leptanthus ovalis* M[ichau]x Marshy pond on road from Lex[ingto]n to Frankfort [probably Woodford Co.] Sep[tembe]r [3] 1834.” [C/P 819(a)] [Isaac C. Martindale Herbarium, NA]

JUNCACEAE

Juncus effusus L.—“*Juncus effusus* ? Wet flats on Red river [probably near forge], K[entuck]y June [2] 1834.” [C/P 771(c)]

Juncus tenuis Willd.—“*Juncus tenuis* fields, Lex[ingto]n May 1834.” [C/P –]

LILIACEAE

Allium canadense L.—“*Allium canadense* L. Near Pittsburg, Penn[sylvani]a. Meadow. July, 1831.” [C/P: None in July, 1831. “No. 370. *Allium canadense* (hex. mon.) June 7, 1831. Meadow garlic. Meadow back of penitentiary.”]

Allium cernuum Roth.—“*Allium cernuum*. Near Pittsburg, Penn[sylvani]a. July 1831. poor specimen.” [C/P: “No. 379. *Allium cernuum* Hex. mon. Woods hillside. July 25, 1831.” X-ref. to 370.]

Allium tricoccum Ait.—“*Allium tricoccum* Leaves, in April Flowers in July 1834 Banks of Elk Lick, Kent[uck]y river.” [C/P –]

Camassia fraseri Torr.—“*Phalangium esculentum* Thickets [Williams’ thicket] about Lex[ingto]n, April [29] 1834.” [C/P 746(a)]

Camassia scilloides (Raf.) Cory —“*Phalangium esculentum* Thickets [Warfield’s woods] about Lex[ingto]n May [11] 1835.” [C/P 822(n)] [PH]

Erythronium albidum Nutt.—“*Erythronium albidum* fields about Lex[ingto]n, [Winslow’s thicket] March [17] 1834.” [C/P –]

Erythronium americanum Ker —“*Erythronium americanum* Woods near Lex[ingto]n Ap[ri]l 1834.” [C/P –] [PH]

Medeola virginiana L.—“*Gyromia virginica* Shadey Valley near Irvine [near Chalybeate spring, Lewis Co.] June [2] 1834.” [C/P 777(a)]

Smilacina racemosa (L.) Desf.—“*Convallaria racemosa* *Smilacina racemosa* Desf. Pennsylvania n.d. Spiked Solomon Seal poor specimen.” [C/P: *Convallaria Racemosa* No. 80. 6.1 Spiked Solomon Seal stem subgeniculate Woods flowers small May 12, 1828.” X-ref. 54 = reference to “*Convallaria angustifolia*, two-flowered Solomon’s Seal leaves more than 3-nerved. Woods side of [?] May 15, 1828. 6.1”]

Trillium grandiflorum (Michx.) Salisb.—“*Trillium grandiflorum* Pittsburg Penn[sylvani]a n.d.” [C/P: “*Trillium grandiflora* No. 42 May 2, 1828 false wake robin”]

Trillium sessile L.—“*Trillium sessile* Thickets about Lex[ingto]n [woods beyond Warfield’s, N. side of Winchester Road] April [9] 1834.” [C/P 727(c)] —“*Trillium sessile* Woods etc. May 1835.” [Thomas C. Porter Herbarium, PH] [C/P –]

AMARYLLIDACEAE

Agave virginica L.—“*Agave virginica* Dry hill top [above petrified falls, Elk Lick], near Kent[uck]y river July [19] 1834.” [C/P 799(n)] [Also 1 specimen at PH]

Hypoxis hirsuta (L.) Coville var. *hirsuta* —“*Hypoxis erecta* Hill top [woods] near Battlefield, Blue Lick Ap[ri]l [23–4–5] 1834.” [C/P 740(c)]

IRIDACEAE

Iris hexagona Walt.—“*Iris hexagona* (Walt.) Wet place [swamp near Woodford road] near Lex[ingto]n June [20] 1835.” [C/P 839(a)] [PH]

Iris versicolor L.—“*Iris virginica* Wet flats on Red river [probably near forge, Powell Co.], K[entuck]y June [2] 1834.” [C/P 771(b)]

Sisyrinchium anceps Cav. [?] —“*Sisyrinchium anceps* Woods, [Rodgers’] May [25, 1833].” [C/P 483(b)]

ORCHIDACEAE

Arethusa bulbosa L.—“*Arethusa bulbosa*. New Jersey May. from Dr. R. E. Griffith, Phil[adelphi]a.” [Note: This specimen stamped “Estate of Adams Jewett, M.D.,” not Douglass Houghton.]

Corallorhiza wisteriana Conrad —“*Corallorrhiza odontorrhiza* Bank [of] Licking river, Blue Lick, [Nicholas Co.] Ap[ri]l [23–4–5] 1834.” [C/P 742(b)]

ANGIOSPERMAE–DICOTYLEDONAE

SAURURACEAE

Saururus cernuus L.—“*Saururus cernuus* Wet margins of brook, etc., near Lex[ingto]n [Wolf’s Run] July [2] 1834.” [C/P 794(b)]

ULMACEAE

Celtis occidentalis L.—“*Celtis crassifolia* Woods [about] Lex[ingto]n April [19] 1834 Large tree Poor spec[ime]n!” [C/P 734(a)]

Celtis occidentalis L. var. *pumila* Gray —“*Celtis pumila* Bank, Kent[uck]y river, [upper Shaker’s ferry] (in fruit) June [5] 1834.” [C/P 785(k)]

Ulmus alata Michx.—“*Ulmus alata* Top of a [Sweet Lick] Knob, Irvine, [Estil Co.] June [1] 1834.” [C/P 778(a)]

MORACEAE

Morus rubra L.—“*Morus rubra* [Probably vicinity of Lexington] May 1834.” [C/P –]

URTICACEAE

Urtica chamaedryoides Pursh —“*Urtica urens* Woods about Lex[ingto]n [beyond Warfield’s] April [9] 1834.” [C/P 727(a)]

ARISTOLOCHIACEAE

Asarum canadense L.—“*Asarum canadense* Rich shadey valley near Kent[uck]y river [Rodgers’] April [5] 1834.” [C/P 720(e)]

POLYGONACEAE

Polygonum erectum L.—“*Polygonum erectum* [Probably vicinity of Lexington] Corn - wet Sep[tembe]r [1834].” [C/P –]

Polygonum lapathifolium L.—“*Polygonum lapathifolium* Wet bank of a [Raven] creek, Kent[uck]y river, Aug[ust 23] 1834.” [C/P 814(a)]

Polygonum virginianum L.—“*Polygonum virginianum* Woods [Probably vicinity of Lexington] Aug[ust 1834].” [C/P –]

CHENOPODIACEAE

Chenopodium ambrosioides L. var. *anthelminticum* (L.) Gray —“*Chenopodium anthelminticum* Banks, Kent[uck]y river Aug[ust] 1834.” [C/P –]

AMARANTHACEAE

Acnida tamariscina (Nutt.) Wood —“*Acnida cannabina* Sandy beach of Ohio river, [North Bend at Cincinnati], Ohio Sept[embe]r 1833 Dwarfish specimens.” [C/P 693]

Iresine paniculata (L.) Ktze.—“*Iresine celosioides* Alluvial banks, Kent[uck]y river, [Boonsborough] Aug[ust 8] 1834.” [3 sheets] [C/P 812(c)] [Also 1 specimen in Thomas C. Porter Herbarium, PH]

CARYOPHYLLACEAE

Arenaria patula Michx.—“*Arenaria stricta* Dry rocks near Kent[uck]y river, [Rodgers’] May [10] 1834.” [C/P 749(c)] —“*Arenaria patula* Cliffs, [upper Shaker ferry] Kent[uck]y river May [23] 1835.” [C/P 829(r)] [PH]

Cerastium nutans Raf.—“*Cerastium longipeduncularis* Fields about Lex[ingto]n May 1834.” [C/P –]

Cerastium vulgatum L.—“*Cerastium vulgare* Field near Lex[ingto]n, [Williams’ thicket] Ap[ri]l [29] 1834.” [C/P 746(b)]

Silene rotundifolia Nutt.—“*Silene rotundifolia* (catch-fly) Cliffs [upper Shaker ferry], Kent[uck]y river June [5] 1834.” [C/P 788] [Isaac C. Martindale Herbarium, NA]

Silene stellata (L.) Ait.—“*Cucubalus stellatus* [Williams’] thicket near Lex[ingto]n [June 1833].” [C/P 533]

Stellaria fontinalis (Short & Peter) Robinson —“*Sagina fontinalis* (N.S.) Wet places on the cliffs of Kent[uck]y river, etc. [where springs flow over rocks, near Rodgers’ at the Richmond Road] Ap[ri]l [5] 1834.” [C/P 725(a)] Note on sheet: “Possibly type. See Transylvania Journ. Med. 28,600 (not at Michigan). Trans J Med 600, 1836.” [See text of article for Peter’s own notes in his “Catalogue of Plants.” (p. 34)]

Stellaria pubera Michx.—“*Stellaria pubera* Shadey vallies near Kent[uck]y river [Rodgers'] Ap[ri]l [5] 1834.” [C/P 726]

RANUNCULACEAE

Actaea alba (L.) Mill.—“*Actaea alba* Shadey hill side [woods], Blue Lick Ap[ri]l [23–4–5] 1834.” [C/P 737]

Anemonella thalictroides (L.) Spach.—“*Anemone thalictroides* *Thalictrum* ?? Woods near Kent[uck]y river March 1834.” [C/P 716(c)]

Clematis virginiana L.—“*Clematis virginica* Fence corner near Lex[ingto]n Aug[ust] 1833.” [C/P –]

Delphinium tricornes Michx.—“*Delphinium tricornes* Hills, Blue Lick [Common] Ap[ri]l [23–4–5] 1834.” [C/P 742]

Hepatica acutiloba DC.—“*Hepatica acutiloba* Vallies - woods [Probably near Lexington] Ap[ri]l 1834.” [C/P –]

Hydrastis canadensis L.—“*Hydrastis canadensis* [Left bank Indian creek, woods, hillside], Blue Lick Ap[ri]l [23–4–5] 1834.” [C/P 740(b)] [Also 1 specimen in Thomas C. Porter Herbarium, PH]

Isopyrum biternatum (Raf.) Torr. & A. Gray —“*Isopyrum thalictroides* *Enemion biternatum* (Raf.) Woods about Lex[ingto]n March [23] 1834.” [C/P –]

Ranunculus pusillus Poir.—“*Ranunculus pusillus* Wet meadow near Richmond June [1] 1834.” [C/P 782]

Thalictrum dioicum L.—“*Thalictrum dioicum* Banks of [Elkhorn] creek [at Maysville Road] near Lex[ingto]n Ap[ri]l [1] 1834.” [C/P 719-2(d)]

Thalictrum polygamum Muhl.—“*Thalictrum comprellum* Woods, banks of Kentucky river [Rodgers'] July [19] 1834.” [C/P 799(g)]

BERBERIDACEAE

Caulophyllum thalictroides (L.) Michx.—“*Caulophyllum thalictroides* Open woods about Lex[ingto]n, [banks of Elkhorn Creek at the Maysville Road] April [19] 1834.” [C/P 733 1/2 (d)]

Jeffersonia diphylla (L.) Pers.—“*Jeffersonia diphylla* Woods [near old paper mill], Lex[ingto]n March [23] 1834.” [C/P 717] [Isaac C. Martindale Herbarium, NA]

MENISPERMACEAE

Cocculus carolinus (L.) DC.—“*Cocculus carolinianus* DC. *Wendlandia populifol.* Cliffs, Kent[uck]y river [Rodgers'] August 17 1833.” [C/P 648]

Menispermum canadense L.—“*Menispermum canadense* Near Pittsburg, Penn[sylvani]a. n.d. poor specimen.” [C/P: “No. 216. *Menispermum virginicum*. or ~~canadense~~ 21.13 Moonseed. Woods. Side of coal-hill.”]

ANNONACEAE

Asimina triloba (L.) Dunal —“*Porcelia triloba* Banks, Kent[uck]y river, [probably Fayette Co.] Ap[ri]l 1834.” [C/P –]

LAURACEAE

Sassafras variifolium (Salisb.) Kuntze —“*Laurus sassafras* (fl. & fruit) Kentucky n.d.” [Probably vicinity of Lexington ca. April 1834] [C/P –]

PAPAVERACEAE

Corydalis aurea Willd.—“*Corydalis aurea* Thickets [Winslow's, Lexington] March [17] 1834.” [C/P 714(h)] [Isaac C. Martindale Herbarium, NA]

Stylophorum diphyllum Michx.—“*Meconopsis petiolatum* Kentucky river [Rodgers'] Ap[ri]l [5] 1834.” [C/P 721(b)] [Isaac C. Martindale Herbarium, NA]

CRUCIFERAE

Arabis laevigata (Muhl.) Poir.—“*Arabis falcata* Banks of brooks, etc. [Probably vicinity of Lexington] Ap[ri]l 1834.” [C/P –]

Cardamine hirsuta L.—“*Cardamine pennsylvanica* Wet. Banks of Elkhorn Creek, Lex[ingto]n Ap[ri]l 1834.” [C/P –]

Dentaria diphylla Michx.—“*Dentaria diphylla* Damp, shadey vallies near K[entuck]y river [Rodgers'] Ap[ri]l [5] 1834.” [C/P 720(c)]

Dentaria heterophylla Nutt.—“*Dentaria heterophylla* Woods, [cliffs of] Kent[uck]y river [Rodgers'] Ap[ri]l [5] 1834.” [C/P 720(d)]

Draba ramosissima Desv.—“*Draba dentata* Cliffs of Kent[uck]y river [Rodgers'] May [10] 1834.” [C/P 749(f)] —“*Draba dentata* (Hooker) Cliffs, Kent[uck]y river [Rodgers'] Ap[ri]l & May 1834 [Hand of R. Peter (R. S.).]” Second label on sheet: “*Draba dentata*, Hook. *Alyssum dentatum*, Mett. [Hand of C. W. Short (R. S.)] Cliffs of K[entuck]y river [Rodgers'] C. W. Short, M.D., Lexington, 1835.” [cf. C/P 749(f)] [Thomas C. Porter Herbarium, PH]

Hesperis pinnatifida Michx.—“*Hesperis pinnatifida* Thickets etc. about L[exingto]n May 1833.” [(Herbarium of Columbia University, New York) NY] [C/P 443]

Iodanthus pinnatifidus (Michx.) Steud.—“*Hesperis pinnatifida* Thickets [Williams'] about Lex[ingto]n May [17] 1834.” [C/P 763(d)] —“*Hesperis pinnatifida* Woods etc. [near Woodford road & old paper mill on Wolf run], Lex[ingto]n June [20] 1835.” [C/P 837(m)] [Charles W. Short Herbarium, PH]

Rorippa islandica (Oeder ex Murray) Borbas subsp. *glabra* (O. E. Schulz) Stuckey var. *fernaldiana* (Butters et Abbe) Stuckey —“*Barbarea vulgaris* Wet. Lex[ingto]n May 1834.” [C/P –]

Sisymbrium canescens Nutt.—“*Sisimbrium canescens* ? (Wet) Kent[uck]y river [Shaker Ferry] May [19] 1834.” [C/P 764(a)]

PODOSTEMACEAE

Podostemon ceratophyllum Michx.—“*Podostemon ceratophyllum* Under water, on rocks, in the ripples of Kent[uck]y river [probably near Rodgers'] Aug[ust] 1833.” [C/P 642]

CRASSULACEAE

Sedum pulchellum Michx.—“*Sedum pulchellum* K[entuck]y Dr. Peter [n.d.].” [cf. C/P 486 Kentucky river, Rodgers' May 25 1833] [Isaac C. Martindale Herbarium, NA] —“*Sedum pulchellum* On rocks. Banks, Kent[uck]y river [probably near Rodgers'] May 1834.” [C/P –]

SAXIFRAGACEAE

Heuchera pubescens Pursh —“*Heuchera pubescens* on rocks. Banks of Red river [probably near forge] June [2] 1834.” [C/P 768(d)]

Heuchera villosa Michx.—“*Heuchera caulescens* Rocky banks, Elk lick, K[entuck]y river July [19] 1834.” [C/P 799(1)]

Heuchera villosa Michx. var. *macrorhiza* R. B. L. det. 1933 —“*Heuchera caulescens* On Rocks, Bank, Kent[uck]y river. Aug[ust] 1835.” [C/P –] [PH]

Saxifraga virginiana Michx.—“*Saxifraga virginiana* Rocks [opposite villa on Elkhorn] near Lex[ingto]n March [27] 1834.” [C/P 719(d)]

HAMAMELIDACEAE

Hamamelis virginiana L.—“*Hamamelis virginica* Banks of creek [Elk Lick, near] Kent[uck]y river Oct[ober] 16] 1834.” [C/P 822]

ROSACEAE

Agrimonia parviflora Ait.—“*Agrimonia suaveolens* (Ph) Dry meadow, Boonsborough Aug[ust] 8] 1834.” [C/P 809(a)] —“*Agrimonia suaveolens* Wet places, Olympian Springs, K[entuck]y Aug[ust] 1835.” [C/P –] [PH]

Agrimonia striata Michx.—“*Agrimonia eupatoria* Woods, Olympian Springs, K[entuck]y Aug[ust] 10–20] 1835.” [C/P 876(e)] [PH]

Crataegus coccinea L.—“*Crataegus populifolia* [Rocky bluff of Elkhorn Creek near Maysville Road, E. of] Lex[ingto]n Ap[ri]l [19] 1834.” [C/P 735(a)]

Crataegus crus-galli L.—“*Crataegus crus-galli* Lex[ingto]n Ap[ri]l 1834.” [C/P –]

Geum album Gmel.—“*Geum virginianum* Woods about Lex[ingto]n July 1834.” [C/P –]

Geum vernum (Raf.) Torr. & A. Gra —“*Stylipus verna* (Raf.) Fields etc. [Warfield's woods near Lexington] May [11] 1835.” [C/P 822(k)] [PH]

Gillenia stipulacea Nutt.—“*Gillenia stipulacea* Woods, hills near Irvine June [2] 1834.” [C/P 770(b)]

Prunus angustifolia Marsh.—“*Prunus chicasa* [Williams' thicket], About Lex[ingto]n Ap[ri]l [15] 1834.” [C/P 731(a)]

Prunus serotina Ehrh.—“*Prunus Virginiana* [Swampy meadow on Woodford road, ? Fayette Co.] May [14] 1835.” [C/P 822(u)] [Charles W. Short Herbarium, PH]

Prunus virginiana L.—“*Prunus obovatus* Banks of Elkhorn [Creek, at the Maysville turnpike, E of] Lex[ingto]n April [19] 1834.” [C/P 733 1/2 (e)]

Rosa setigera Michx.—“*Rosa rubifolia* Rocky banks, Kent[uck]y river [near Rodgers'] June [21] 1834.” [C/P 791] —“*Rosa rubifolia* Blue Lick June 1835.” [See C/P 842(p), July 1–2–3, 1835.] [PH]

LEGUMINOSAE

Amphicarpa monoica (L.) Ell.—“*Amphicarpa monoica* Shadey woods [probably vicinity of Lexington] July 1833.” [C/P –]

Apios tuberosa Moench.—“*Apios tuberosa* Woods [probably vicinity of Lexington] July [ca. 1834].” [C/P –] —“*Apios tuberosa* Banks of brook Olympian Springs, K[entuck]y [August 10–20 1835].” [C/P 876(f)] [PH]

Astragalus canadensis L.—“*Astragalus canadensis* Dry hills Blue Lick, K[entuck]y July [1-2-3] 1835.” [C/P 842(g)] [PH]

Cassia nictitans L.—“*Cassia nictitans* Red river, K[entuck]y [Mr. Griswold] July 1833.” —“*Cassia nictitans* Woods - hill sides Olympian Springs Aug[ust 10–20] 1835.” [C/P 875(j)] [PH]

Cladrastis lutea (Michx. f.) Koch —“*Virgilia lutea* var. *alba* Banks, Kent[uck]y river [Lewis' ferry, near Shakertown] May [11] 1833.” [C/P 442]

Desmodium grandiflorum (Walt.) DC.—“*Hedysarum acuminatum* Woods, Kent[uck]y river [near Rodgers'] June [21] 1834.” [C/P 789(k)] [2 sheets]

Desmodium pauciflorum DC.—“*Hedysarum pauciflorum* (Nutt.) Open woods [dry], near [old paper-mill], Lex[ingto]n July [13] 1833.” [C/P 595]

Desmodium rotundifolium DC. [Not det. by __ G.S., (R. S.)] —“*Hedysarum rotundifolium* Woody hill side Olympian Springs, K[entuck]y Aug[ust 10–20] 1835.” [C/P 876(d)] [PH]

Hedysarum marilandicum L. —“(Penciled above) *Desmodium maril.* Boot. Banks Kent[uck]y river, Raven's Creek Aug[ust 16] 1834” [C/P 812(r)]

Lespedeza procumbens Michx.—“*Lespedeza procumbens* Dry ridge, road to Cincinnati [Grant Co.] Sep[tembe]r 1833.” [C/P –]

Lespedeza violacea (L.) Pers.—“*Lespedeza violacea*, Pers. Thickets near Lexington, Kentucky. R. Peter M.D. (Ex. Madsch Herb.) Aug[ust] 1838 [Not an original Peter label (R. S.)] [(Herbarium of Alex MacElwer[?]) PH]

Phaseolus polystachyus (L.) B. S. P.—“*Phaseolus perennis* Woods, banks, Kent[uck]y river, [near Rodgers'] July 1834.” [C/P 799(r)]

Strophostyles helveola (L.) Ell.—“*Strophostyles angulosa* Beach of Ohio river [probably vicinity of North Bend, near Cincinnati.] Sep[tembe]r 1833.” [C/P –]

Strophostyles umbellata (Muhl.) Britt.—“*Strophostyles peduncularis* Hills about Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 856(b)] [PH]

Stylosanthes biflora (L.) B. S. P.—“*Stylosanthes elatior* Sandy hills near Red river [possibly near forge], K[entuck]y July 1834.” [C/P –]

Tephrosia virginiana (L.) Pers.—“*Galega virginiana* Dry hill-side [top of Sweet Lick knob] near Irvine, K[entuck]y June [1] 1834.” [C/P 778(b)]

Trifolium stoloniferum Muhl.—“*Trifolium stoloniferum* Fields about Lex[ingto]n May 1834 (Vulg. 'Buffalo Clover').” [C/P –] —“*Trifolium stoloniferum* Meadows etc. [about Lexington] June 1835.” [C/P 830(b)] [Thomas C. Porter Herbarium, PH]

Vicia cracca L.—“*Vicia cracca* Woods [cliffs], Kent[uck]y river [near Rodgers'] Ap[ri]l [5] 1834.” [C/P 720(i)]

OXALIDACEAE

Oxalis stricta L.—“*Oxalis stricta* Woods near Lex[ingto]n May 1833.” [C/P –]

RUTACEAE

Ptelea trifoliata L.—“*Ptelea trifoliata* Banks Kent[uck]y river [Upper Shakers ferry] fl May [19]; frt June [5] 1834.” [Annotated: Revision of *Ptelea* (Rutaceae) *Ptelea trifoliata* L. subsp. *trifoliata* var. *trifoliata* Virginia Bailey, Univ. of Mich., October, 1958] [C/P 714(b) & C/P 784(d)]

POLYGALACEAE

Polygala senega L.—“*Polygala Senega* Shady banks of Boon[e]'s creek, Kent[uck]y river May [25] 1833.” [C/P 473] [Herbarium of Columbia University, New York, NY] —“*Polygala senega* Banks, Kent[uck]y river, [Upper Shaker's ferry] June [5] 1834.” [C/P 789(e)]

Polygala senega L. var. *latifolia* Torr. & A. Gray —“*Polygala senega* Top of cliff, Kent[uck]y river, [Upper] Shaker ferry June [5] 1834.” [C/P 789(e)] [Thomas C. Porter Herbarium, PH]

EUPHORBIACEAE

Euphorbia corollata L.—“*Euphorbia corollata* Cliffs, Kent[uck]y river, [Boonsborough] Aug[ust] 8] 1834.” [C/P 811(b)]

Euphorbia peplus L.—“*Euphorbia peplus* Open wood, [Kentucky River near Rodgers'] May [25] 1833.” [C/P 485]

BUXACEAE

Pachysandra procumbens Michx.—“*Pachysandra procumbens* Cumberland & Barren rivers, K[entuck]y Feb[ruary] & March [ca. 1834].” [C/P –] [Also one specimen at PH, det. A. C. Robbins, 1960]

LIMNANTHACEAE

Floerkea proserpinacoides Willd. [Note: No writing by Peter on this sheet, but in his “Catalogue” is “No. 730, *Floerkea uliginosa*, April 9, 1834 Wet, damp, Warfield's wood. Duplication 706 (Dr. Short).”]

ANACARDIACEAE

Rhus aromaticum Ait.—“*Rhus aromaticum* Banks of Elkhorn [creek] near Lex[ingto]n April 1834.” [cf. C/P 747(a) May 3 1834] [Isaac C. Martindale Herbarium, NA]

Rhus glabra L.—“*Rhus glabrum*.” [Charles W. Short Herbarium, PH] [C/P 558(c)]

CELASTRACEAE

Celastrus scandens L.—“*Celastrus scandens* [Margin of field, damp, top of cliff, Upper Shaker's ferry], Kentucky river June [5] 1834.” [C/P 789(c)] *Euonymus atropurpureus* Jacq.—“*Euonymus atropurpureus* Banks, Kent[uck]y river May 1834.” [C/P –]

Euonymus obovatus Nutt.—“*Euonymus obovatus* [Rocks, etc., Rodgers'], Kentucky river May [10] 1834.” [C/P 760(b)]

STAPHYLEACEAE

Staphylea trifolia L.—“*Staphylea trifolia* (Bladder-nut) Near L[e]x[ington]—banks of Brook May 1834.” [C/P –] [Isaac C. Martindale Herbarium, NA]

HIPPOCASTANACEAE

Aesculus glabra Willd. [Note: No writing by Peter on this sheet, but this may be the same plant as the one entered in Peter's “Catalogue” as “*Aesculus ohioensis* (M[ichau]x, No. 733, April 15, 1834, Williams' thicket, Lexington.”]

Aesculus glabra × *octandra* [Det. Hardin 1956] —“*Aesculus ohioensis* Woods [Winslow's thicket] about Lex[ingto]n May [6] 1835.” [C/P 822(f)] [PH]

Aesculus macrostachya Michx. —“[not Peter's label] *Aesculus Macrostachya* White Buck eye woody damp rich soil B. Co. L.P. June 29” [MICH label: *Aesculus macrostachya* Damp, rich soil, Boone Co. Kentucky Robert L. Peter June 29, 1834.] [Annot.: Revision of the American Hippocastanaceae *Aesculus parviflora* Walt. James W. Hardin 1956. Herbarium of E. C. Almendinger] [C/P –]

RHAMNACEAE

Ceanothus americanus L.—“*Ceanothus americanus* Cliffs [near Rodgers', Kent[uck]y river June [21] 1834.” [C/P 789(c)]

Rhamnus caroliniana Walt.—“*Rhamnus carolinianus* Cliffs, Boon[e]'s Creek, Kent[uck]y river May 1835.” [C/P –]

Rhamnus lanceolata Pursh —“*Rhamnus Shortii* (Nutt) Rocky banks Kent[uck]y river May 1833.” [Note: *Rhamnus lanceolatus* is entered as C/P 484 1/2 on May 25, 1833, from Rodgers', Kent[uck]y river.] [Thomas C. Porter Herbarium, PH]

VITACEAE

Vitis bicolor Le Conte [F. V. M. '89] —“*Vitis riparia* (odoriferous grape) Pittsburgh P[ennsylvani]a [May 29 1830] —Dr. R. Peter [Short's writing (R. S.)] [C/P 344] [Charles W. Short Herbarium, PH]

TILIACEAE

Tilia heterophylla Vent.—“*Tilia pubescens* Blue Lick, K[entuck]y June [July 1–2–3] 1835.” [C/P 842(h)] [PH]

HYPERICACEAE (GUTTIFERAE)

Ascyrum hypericoides L. var. *multicaule* (Michx.) Fernald [William P. Adams, 1956] —“*Ascyrum crus-andraea* Hill tops etc. near Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 851(f)] [PH]

Hypericum gentianoides (L.) B. S. P.—“*Sarothra hypericoides* Hills & fields Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 848(d)] [PH]

Hypericum mutilum L.—“*Hypericum parviflorum* Beach, Kent[uck]y river [at Boonsborough] Aug[ust 8] 1834.” [C/P 811(d)] —“*Hypericum parviflorum* Old field Crab Orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 849(b)] [PH]

Hypericum perforatum L.—“*Hypericum perforatum* Banks [growing in crevices in rocky beach of] Kent[uck]y river, [at Combs’ ferry] July [6] 1833.” [C/P 583(d)]

Hypericum prolificum L. [Det. Adams 1959] —“*Hypericum prolificum* Old field Olympian Springs, K[entuck]y Aug[ust 10–20] 1835.” [C/P 876(h)] [PH]

CISTACEAE

Lechea racemulosa Michx.—“*Lechea racemulosa* Hill tops – woods near Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 864] [PH]

VIOLACEAE

Hybanthus concolor (T. F. Forst.) Spreng.—“*Ionidium concolor* Woods, rocky, near Lex[ingto]n April 1834.” [C/P –]

Viola canadensis L.—“*Viola canadensis* Woods, Pittsburg May 1834.” [cf. C/P: “No. 60 *Viola Canadensis* 5.1 Woods violet Damp woods root fibrous, pet[als] purple white on outside. May 5, 1828.”]

Viola cucullata Ait.—“*Viola cucullata* Woods, etc., Lex[ingto]n March 1834.” [C/P –]

Viola pedata L.—“*Viola pedata* Licking river, [Nicholas Co.] K[entuck]y May.” [cf. C/P 503 Mud Lick C. Peck May 1833] [Isaac C. Martindale Herbarium, NA]

Viola striata Ait.—“*Viola striata* Fields, etc. [Williams’ thicket] about Lex[ingto]n April [15] 1834.” [C/P 730(b)]

LYTHRACEAE

Cuphea viscosissima Jacq.—“*Cuphea viscosissima* Dry road side [Kentucky River, Elk Lick] Aug[ust 16] 1834.” [C/P 812(x)]

ONAGRACEAE

Circaea lutetiana L. —“*Circaea lutetiana* Woods Blue Lick, K[entuck]y June [July 1–2] 1835.” [C/P 842(m)] [PH] —“*Circaea lutetiana* Woods, about Lex[ingto]n June 1834.” [C/P –]

Epilobium coloratum Muhl.—“*Epilobium coloratum* Damp [probably vicinity of Lexington] Aug[ust] 1834.” [C/P –]

Oenothera muricata L.—“*Oenothera muricata*.” [C/P –] [Charles W. Short Herbarium, PH]

ARALIACEAE

Panax quinquefolia L.—“*Panax quinquefolium* L. Poor specimen. Pittsburg, P[ennsylvani]a April 1829.” [cf. C/P: “No. 225. *Panax quinquefolium* 5.2 Ginseng side of coal hill - woods July 4, 1829.”]

UMBELLIFERAE

Chaerophyllum procumbens (L.) Crantz —“*Chaerophyllum procumbens* Fence corners etc. Lex[ingto]n Ap[ri]l May 1833. [Noted on sheet, “Ex Herb. Durand (R. S.)”] [C/P 440] [PH] —“*Chaerophyllum procumbens* Fence corners, [Williams’ thicket], Lex[ingto]n Fl. April [15], Fr. May 1834.” [C/P 731(b)]

Cicuta maculata L.—“*Cicuta maculata* Damp [probably vicinity of Lexington] July [ca. 1834].” [C/P –]

Cryptotaenia canadensis (L.) DC.—“*Chaerophyllum canadense* (Damp) Near Lex[ingto]n [June 1833].”

Erigenia bulbosa Nutt.—“*Erigenia bulbosa* Woods about Lex[ingto]n March 1834.” [C/P 719(b)]

Osmorhiza longistylis DC.—“*Uraspermum claytoni* *Osmorrhiza longistylis* (sweet cicily) Banks, Kent[uck]y river, [probably at Rodgers’] May 1834.” [C/P –]

Thaspium barbinode Nutt. — “[Not Peter’s label] Lexington, Ky. Coll. Dr. Houghton” [In ink on sheet: Lexington, Ky. Dr. Houghton] [Note: Peter first collected this plant on May 6, 1828, in the vicinity of Pittsburgh.] [C/P –]

CORNACEAE

Cornus drummondii C. Meyer — “*Cornus alba* Banks, Kent[uck]y river, [Lower Shaker’s ferry] June [5] 1834.” [C/P 784(c)]

Cornus florida L. — “*Cornus florida* Blue Lick, Licking river Ap[ri]l [23–4–5] 1834.” [C/P 744(d)]

ERICACEAE

Kalmia latifolia L. — “*Kalmia latifolia* Banks, Red river [probably near forge], K[entuck]y June [2] 1834.” [C/P 776(b)]

Oxydendrum arboreum (L.) DC. — “*Andromeda arborea* Woods & fields Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 854(a)] [C/P 854(a)] PH]

PRIMULACEAE

Dodecatheon meadia L. — “*Dodecatheon meadea* Cliffs of Kent[uck]y river, [Rodgers’] April [5] 1834.” [C/P 720(a)] — “*Dodecatheon Meadia* (in fl.) Cliffs [probably near Shaker ferry], Kent[uck]y river May 1835.” [cf. C/P 829(n)] [PH]

Hottonia inflata L. — “*Hottonia inflata* Pond near Red river, [in swamp; probably near forge] June [2] 1834.” [C/P 774(b)]

Lysimachia ciliata L. — “*Lysimachia ciliata* Damp, [Wolf’s Run] near Lex[ingto]n July [2] 1834.” [C/P 795 1/2 (b)] [Also one specimen at PH]

Lysimachia hybrida Michx. — “*Lysimachia hybrida* Wet, meadow near Lex[ingto]n July 1834.” [C/P –] [2 specimens]

Lysimachia lanceolata Walt. — “*Lysimachia quadriflora* Hills about Blue Lick, K[entuck]y June [July 1–2–3] 1835.” [C/P 842(i)] [PH]

Lysimachia quadrifolia L. — “*Lysimachia quadrifolia* Woods [on hills] near [Red River], Irvine, K[entuck]y June [2] 1834.” [C/P 770(d)]

Samolus floribundus H. B. K. — “*Samolus valerandi* Alluvial banks, Kent[uck]y river, Boonsborough, K[entuck]y wet Aug[ust 8] 1834.” [C/P 811(c)] — “*Samolus valerandi* Wet places Blue lick, K[entuck]y June 1835.” [C/P –] [PH]

EBENACEAE

Diospyros virginiana L. — “*Diospyros virginiana* Banks, Kent[uck]y river, [Lower Shaker’s ferry] June [5] 1834.” [C/P 785(a)]

GENTIANACEAE

Frasera carolinensis (Walt.) Ktze. [past annot. (R. S.)] — “*Frasera Walteri* Cliffs, Kent[uck]y river June 1835.” [C/P –] [PH]

APOCYNACEAE

Apocynum cannabinum L. — “*Apocynum hypericifolium* Rocky beach of Kentucky river, [Combs’ ferry] July [6] 1833.” [C/P 584(a)] — “*Apocynum cannabinum* Side of Brook [back of Warfield’s Woods] near Lex[ingto]n June 1833.” [C/P 570]

ASCLEPIADACEAE

Ampelamus albidus (Nutt.) Britt. — “*Enslenia albida* River alluvions Kentucky & Ohio rivers July 1833.” [C/P 626] [PH]

Asclepias incarnata L. — “*Asclepias amoena* Fields - sides of Brooks [probably vicinity of Lexington] Aug[ust] 1834.” [C/P –]

Gonolobus gonocarpos (Walt.) Perry — “*Gonolobus macrophyllus* Fence, near Versailles, [road to Sublett’s, Woodford Co.] K[entuck]y July [3, 4] 1834.” [C/P 796] [2 specimens; on the second one, writing on label not Peter’s.]

Gonolobus laevis Michx. — “*Enslenia albida* Alluvial banks, Kent[uck]y river, Boonsborough Aug[ust 8] 1834.” [C/P 812(d)] [2 specimens]

Matelea decipiens (Alexander) Woods. — “*Gonolobus hirsutus* Dry, rocky, woods. Near Kentucky river [Rodgers’] July 1834.” [C/P – But see No. 601, July 20, 1833.]

Vincetoxicum gonocarpus Walt.—“Gonolobus macrophyllus Fence corners near [beyond] Versailles [road to Sublett's, Woodford Co.], K[entuck]y July [3–4] 1834.” [G.* Peteri (annot. by Pickering (R. S.))] [C/P 796] [PH]

POLEMONIACEAE

Phlox divaricata L.—“Phlox divaricata Woods, about Lex[ingto]n March [23] 1834.” [C/P 715(b)]

Phlox maculata L.—“Phlox maculata [Masterson's] meadow, near Lex[ingto]n July 1833.” [C/P 588]

Phlox maculata L. subsp. *odorata* (Sweet) Wherry (ETW. 1934 = *maculata* Gen. Phlox, p. 113, '55) — “Phlox maculata Meadow Boonsborough, K[entuck]y Aug[ust 8] 1834.” [C/P 809(b)] [Charles W. Short Herbarium, PH]

Phlox stolonifera Sims —“Phlox reptans, Michx. stolonifera, Bot. Mag. Kentucky, Dr. Peter From E. Durand's herb. [n.d.].” [Pencil - what I've always considered Durand's writing (R. S.))] [C/P –, except cf. Pittsburg 30(b), April 28 1828] [PH]

Phlox subulata L.—“Phlox setacea Rocks, near Pittsburg, Penn[sylvani]a May.” [C/P: “No. 20 Phlox setacea. 5.1. flowers purple & white. On rocky bank above [?]. April 22, 1828.”]

Polemonium reptans L.—“Polemonium reptans Thicket near Lex[ingto]n March [23] 1834.” [C/P 715(a)] —“Polemonium reptans Thickets [Winslow's] near Lex[ingto]n May [6] 1835.” [C/P 822(c)] [PH]

HYDROPHYLLACEAE

Hydrophyllum appendiculatum Michx.—“Hydrophyllum appendiculatum [Williams' thicket], about Lex[ingto]n May [17] 1834.” [C/P 763(f)]

Phacelia bipinnatifida Michx. (L. C. 1947) —“Phacelia heterophylla Shady valley [Upper Shaker's ferry], Kent[uck]y river May [23] 1835.” [C/P 822(w)] [PH]

Phacelia purshii Buckley —“Phacelia fimbriata [Williams'] Thicket near Lex[ingto]n April [15] 1834.” [C/P 730(c)]

Phacelia purshii Buckl. ssp. *purshii* (____ Baker, 1961) —“Phacelia fimbriata Thickets about Lex[ingto]n April [15] 1834.” [C/P 730(c)] [Thomas C. Porter Herbarium, PH]

BORAGINACEAE

Lithospermum canescens (Michx.) Lehm.—“Batschia canescens [Sterile, rocky] hillside, Blue Lick April [23–4–5] 1834.” [C/P 745(a)]

Mertensia virginica (L.) Link —“Pulmonaria virginica Banks of brook [Wolf's Run], near Lex[ingto]n March [23] 1834.” [C/P 715(d)]

VERBENACEAE

Lippia lanceolata Michx.—“Zapania nodiflora Sandy beach, Kent[uck]y river, [Combs' ferry] July [6] 1833.” [C/P 582]

Verbena angustifolia Michx.—“Verbena angustifolia [Dry] roadside near Kent[uck]y river, [Combs' ferry] July [6] 1833.” [C/P 585(b)]

LABIATAE

Blephilia ciliata Raf.—“Monarda ciliata Fields (damp) about Lex[ingto]n June 1834.” [C/P –]

Blephilia hirsuta (Pursh) Benth.—“Monarda hirsuta Fields about Lex[ingto]n June 1834.” [C/P –]

Dracocephalum cordatum Nutt. —“Dracocephalum cordatum Alluvial banks Kentucky river, [Rodgers'] May [20] 1834.” [C/P 759] [Thomas C. Porter Herbarium, PH]

Dracocephalum virginianum L. (E. McClintock 1947) —“Dracocephalum variegatum Sandy beach Kentucky river, [Rodgers'] July [19] 1834.” [C/P 799(d)] [PH]

Isanthus brachiatus (L.) B. S. P.—“Isanthus coeruleus Dry rocky hill, [mouth of Elk Lick, near Kentucky River] Sep[tembe]r [20] 1834.” [C/P 817(b)]

Meehania cordata (Nutt.) Britt.—“Dracocephalum cordatum Alluvial bank, Kent[uck]y river, [Rodgers'] May [20] 1834.” [C/P 759]

Mentha spicata L.—“Mentha tenue Wet places [probably vicinity of Lexington] July 1834.” [C/P –] — “Mentha viridis Wet places [on Elkhorn Creek] near Lex[ingto]n Aug[ust 30] 1835.” [C/P 887(f)] [PH]

Monarda clinopodia L.—“Monarda oblongata Dry fields [on road to Combs' ferry] near Lex[ingto]n July [6] 1833 Stem purple (dark).” [C/P 583(e)]

Pycnanthemum flexuosum (Walt.) B. S. P.—“Pycnanthemum linifolium Rocky bank, [hillside above petrified falls, Elk Lick], Kent[uck]y river July [19] 1834.” [C/P 799(o)] [Also one specimen at PH]

Pycnanthemum incanum (L.) Michx.—“Pycnanthemum incanum Dry field near Lex[ingto]n July 1833.” [C/P –]

Satureja glabella (Michx.) Briq.—“Cunila glabella (the true plant of M[ichau]x On fragments of limestone, banks of brook, [road to Frankfort] near Lex[ingto]n June [27] 1834.” [C/P 794] [Also one specimen at PH]

Scutellaria nervosa Pursh —“Scutellaria ambigua ? Woods [near Woodford Road and old paper mill on Wolf Run] near Lex[ingto]n June [20] 1835.” [C/P 837(o)] [PH]

Stachys tenuifolia Willd.—“Stachys aspera Alluvial banks, Kent[uck]y river, [Boonsborough] Aug[us]t [8] 1834.” [C/P 812(b)]

SCROPHULARIACEAE

Chelone glabra L.—“Chelone glabra Damp places about Lex[ingto]n Sept[ember] 1834.” [C/P –]

Collinsia verna Nutt.—“Collinsia verna Woods [Winslow’s thicket] near Lex[ingto]n May [6] 1834.” [C/P 749(b)]

Gerardia tenuifolia Vahl.—“Gerardia tenuifolia [Top of] Dry ridge, road to Cincin[n]a[ti, Grant Co.] Sep[tembe]r [28] 1833.” [C/P 690(d)]

Gratiola virginica L. —“Gratiola virginica Sand bar Kent[uck]y river July 1834.” [Penciled on sheet: neglecta] [C/P –]

Lindernia dubia (L.) Pennell var. *major* Pursh —“Lindernia dilatata Beach, Kent[uck]y river Aug[us]t 1834.” [C/P –] [PH]

Pedicularis canadensis L.—“Pedicularis canadensis Hill side, Blue Lick Ap[ri]l [23–4–5] 1834.” [C/P 744(c)]

Penstemon hirsutus (L.) Willd. (F. W. P. 1924) —“Penstemon pubescens Woods & hill sides near Irvine, K[entuck]y June [2] 1834.” [C/P 770(c)] [PH]

Penstemon laevigatum Ait.—“Penstemon laevigatum Banks of a brook, near Lex[ingto]n, [Shaker ferry (Dr. Short)] May [19] 1834.” [C/P 765(b)]

Veronica peregrina L.—“Veronica peregrina Cultiv[ate]d fields near [Warfield’s] Lex[ingto]n Ap[ri]l [9] 1834.” [C/P 727(g)]

ACANTHACEAE

Justicia americana (L.) Vahl —“Justicia pedunculosa Wet, margin of Kent[uck]y river July 1834” [Penciled on label: Dianthera Americana L.; MICH label, Dianthera americana L. (annotated: Univ. of S. Florida Herbarium *Justicia americana* (L.) Vahl, date 1975, determined by Martha Meagher.) [C/P 785(b) Justicia peduncularis listed from Upper Shaker’s ferry on June 5, 1834.]

PHRYMACEAE

Phryma leptostachya L.—“Phryma leptostachia Woods, Lex[ingto]n [common] June 1833.” [C/P 551(e)]

PLANTAGINACEAE

Plantago cordata Lam. (O.K. E. L. M. Dec. 31 ‘04) —“Plantago cordata Lam. Kentuckiensis _____ Canadensis [in pencil (R. S.)] From Kentucky, Dr. Peter From E. Durand’s Her[barium] [n.d.].” [C/P –] [PH]

RUBIACEAE

Galium aparine L.—“Galium aparine Thicket near Lex[ingto]n May 1834.” [C/P –]

Galium lanceolatum Torr.—“Galium lanceolatum Wood, K[entuck]y June 1834.” [C/P –]

Galium tinctorium L.—“Galium tinctorium Meadow near Richmond, K[entuck]y June 1834.” [C/P –]

Houstonia ciliolata Torr.—“Houstonia ciliolata Among the rocks of the Battle field of Blue Lick, K[entuck]y April [23–4–5] 1834.” [C/P 744(a)]

Houstonia intermediate, *H. purpurea* L. × *H. tenuifolia* Nutt. (E. Terrell, 1957) —“Houstonia longifolia Kentucky River [probably Rodgers’] June] 1834.” [C/P 792]

Houstonia longifolia Gaertn.—“Houstonia longifolia Sandy banks, Kent[uck]y river, [Rodgers’] June [21] 1834.” [C/P 792]

Houstonia purpurea L.—“Houstonia purpurea Cliffs, Kentucky river [Rodgers’] June [21] 1834.” [C/P 789(i)]

CAPRIFOLIACEAE

Sambucus racemosa L. *Sambucus pubescens*. Poor spec[ime]n from Pittsburg, Penn[sylvani]a. April 1834." [C/P: No *Sambucus pubescens* from April 1834. Index refers to "No. 32. *Sambucus pubescens* 5.3 Red-berried Elder. Coal hill. April 28, 1828."] [Also one specimens, n.d., in Charles W. Short Herbarium, PH]

Triosteum angustifolium L.—"Triosteum angustifolium Fence corner, Kent[uck]y river, [Rodgers'] May [20] 1834." [C/P 760(a)]

Viburnum prunifolium L.—"Viburnum prunifolium Banks, Licking river, Blue Lick April [23–4–5] 1834." [C/P –]

VALERIANACEAE

Valeriana pauciflora Michx. —"Valeriana pauciflora Banks of creek at Kent[uck]y river, [Rodgers'] does not entirely agree with descript[i]o[n] of V. pauc. May [20] 1834." [C/P 756(b)]

Valerianella umbilicata (Sull.) Wood —"Fedia radiata Damp meadows about [swamp on Woodford Road near] Lex[ingto]n [probably intersection of present-day Wolf Run and U.S. 60] May [6] 1834." [C/P 748(c)]

CAMPANULACEAE

Campanula americana L.—"Campanula acuminata Fence corners about Lex[ingto]n July 1834." [C/P –]

Lobelia cardinalis L.—"Lobelia cardinalis Banks, Kent[uck]y river [near Raven Creek] Aug[ust] 1834." [Annotated: *Lobelia Cardinalis* L. Determined by Rogers McVaugh - 1937.] [C/P 815(b)] —"Lobelia cardinalis Wet places Olympian Springs, K[entuck]y Aug[ust] 10–20] 1835." [C/P 873(e)] [PH]

Lobelia spicata Lam.—"Lobelia claytoniana Roadside near Irvine, K[entuck]y June [1] 1834." [C/P –]

Lobelia siphilitica L.—"Lobelia syphilitica Damp places, Kent[uck]y river, [probably mouth of Elk Lick] Sep[tembe]r 1834." [C/P –]

Lobelia sp. (R. McV. 1934) —"Lobelia pallida Woods, hills Blue Lick, K[entuck]y July [1-2-3] 1835." [C/P –] [PH]

COMPOSITAE

Actinomeris alternifolia (L.) DC.—"Actinomeris squarrosa Common; fence corners, etc. [vicinity of Lexington] Aug[ust] 1834." [C/P –] [Also one specimen at PH]

Antennaria plantaginifolia (L.) Richards.—"Gnaphalium plantagineum [Stoney hills - among rocks] Blue Lick, K[entuck]y Ap[ri]l [23–4–5] 1834." [C/P 744(f)]

Aster cordifolius L.—"Aster cordifolius Shadey vallies, Kent[uck]y river, [Rodgers'] Oct[ober] 16] 1834." [C/P 820(c)]

Aster ontarionis Wieg.—"Aster miser ? Gravelly beach, [mouth of Elk Lick], Kent[uck]y river Sep[tembe]r [20] 1834." [C/P 817(a)]

Aster patens Ait. var. *phlogifolius* Nees —"Aster phlogifolius [Woods, hill side top of] cliff, Kent[uck]y river, [Rodgers'] Oct[ober] 16] 1834." [C/P 821(f)]

Aster pilosus Willd.—"Aster multiflorus. Pittsburg, Penn[sylvani]a. n.d." [C/P: "No. 324. Aster multiflorus. 18_2 W. Hab [?] Pennsylv[ania] Oct[ober] 5, 1829." [X-ref. to Nos. 148, 267, 319, 320, 321, and 323.]

Aster prenanthoides Muhl.—"Aster prenanthoides Damp places about Lex[ingto]n Sep[tembe]r 1834." [C/P –] [2 specimens] [Also one specimen at PH, Schweinitz Herbarium. "Pittsburg, Pennsylvania, 1831."

Aster shortii Hooker —"Aster Shortii Hooker Rocky banks Kent[uck]y river [probably Rodgers'] Sept[ember] 1834." [Torrey Herbarium, NY]

Astranthium integrifolium (Michx.) Nutt. subsp. *integrifolium* —"Bellis integrifolia Hill side, [woods] near Irvine, K[entuck]y June [1] 1834." [C/P 783]

Bidens cernua L.—"Bidens chrysanthemoides Beach of Kent[uck]y river, [mouth of Elk Lick] Sept[ember] 20] 1834." [C/P 816(g)] [PH]

Bidens frondosa L.—"Bidens cernua Banks, Kent[uck]y river, [probably Fayette Co.] Aug[ust] 1834." [C/P –]

Bidens laevis (L.) B. S. P.—"Bidens chrysanthemoides Damp places, [probably beach near Kentucky River, mouth of Elk Lick] Sep[tembe]r [20] 1834." [C/P 816(g)]

- Cacalia atriplicifolia* L.—“*Cacalia atriplicifolia* Banks, Kent[uck]y river, [Rodgers’] Aug[ust 16] 1834.” [C/P 812 1/2 (f)]
- Cirsium altissimum* (L.) Spreng.—“*Cnicus altissimus* Fence corner Near Lex[ingto]n Aug[ust 31] 1833.” [C/P 657]
- Cirsium discolor* (Muhl.) Spreng.—“*Cnicus discolor* Field near Lex[ingto]n Aug[ust 30] 1835.” [C/P 888(a)] [PH]
- Coreopsis auriculata* L.—“*Coreopsis auriculata* Woods near [Red River] Winchester, Kent[uck]y June [2] 1834.” [C/P 770(a)]
- Coreopsis major* Walt.—“*Coreopsis linifolia* Old field Crab orchard, K[entuck]y Aug[ust 2–3] 1835.” [C/P 853] [Thomas C. Porter Herbarium, PH]
- Coreopsis tripteris* L.—“*Coreopsis tripteris* Cliffs of Kent[uck]y river, [Boonsborough] Aug[ust 8] 1834.” [C/P 811(a)] [Also one specimen at PH]
- Eclipta alba* (L.) Hassk.—“*Eclipta procumbens* Beach, Kent[uck]y river, Boonsborough Aug[ust 8] 1834.” [C/P 812(g)]
- Elephantopus carolinianus* Willd.—“*Elephantopus carolinianus* Alluvial bank, Kent[uck]y river, Boonsborough, K[entuck]y Aug[ust 8–9] 1834.” [C/P 812(1)]
- Erigeron philadelphicus* L.—“*Erigeron purpureum* Fields about Lex[ingto]n, [Williams’ thicket, old race track] May [17] 1834.” [C/P 763(e)]
- Erigeron pulchellus* Michx.—“*Erigeron bellidifolium* [Stoney] hill side, Blue Lick, K[entuck]y river Ap[ri]l [23–4–5] 1834.” [C/P 744(e)] [Note: Although Peter’s specimen is inscribed “Kentucky river,” the river which flows past Blue Lick is the Licking River.]
- Eupatorium coelestinum* L.—“*Eupatorium coelestinum* Banks, Kent[uck]y river, Raven Creek Aug[ust 23] 1834.” [C/P 814(j)]
- Eupatorium purpureum* L.—“*Eupatorium purpureum* Alluvial banks of Kent[uck]y river, Boonsborough Aug[ust 8] 1834.” [C/P 811(g)]
- Eupatorium serotinum* Michx.—“*Eupatorium ceanothifolium* Barrens of Kent[uck]y Dr. Short Sep[tember] 1835.” [C/P 922] [PH]
- Eupatorium sessilifolium* L.—“*Eupatorium sessilifolium* Not quite in fl[ower], [Clay’s ferry], Kent[uck]y river [September 14 1833].” [C/P 670] [Also one specimen at PH]
- Gnaphalium polycephalum* Michx.—“*Gnaphalium polycephalum* Woods about Lex[ingto]n, [marsh 12 mi. on road to Frankfort, Woodford Co.] Sep[tembe]r [30] 1834.” [C/P 819(b)]
- Helenium autumnale* L.—“*Helenium autumnale* Common in wet places [probably vicinity of Lexington] Sep[tembe]r 1834.” [C/P –]
- Helianthus decapetalus* L.—“*Helianthus decapetalus* Alluvial banks, Kent[uck]y river, [Rodgers’] Sep[tembe]r [14] 1833.” [C/P 682] —“*Helianthus hispidulus* ? *doronicoides* [added in pencil (R. S.) Banks of Kent[uck]y river [probably Rodgers’] Sept[ember] 1835.” [cf. C/P 890(b)] [PH]
- Heliopsis helianthoides* (L.) Sweet subsp. *helianthoides* —“*Heliopsis laevis* Shadey banks, Kent[uck]y river, [Rodgers’] Aug[ust 30] 1834.” [C/P 813(c)]
- Pluchea camphorata* (L.) DC.—“*Conyza camphorata* Sandy beach, [Elk Lick], Kent[uck]y river Aug[ust 16] 1834.” [C/P 812(r)]
- Polymnia canadensis* L.—“*Polymnia canadensis* [Hillside, wood] Bank, Kent[uck]y river, [Rodgers’] July [19] 1834.” [C/P 799(s)]
- Prenanthes altissima* L. f. *altissima* —“*Prenanthes serpentaria* Dry ridge, woods, [on road to Cincinnati, Grant Co.] Sep[tembe]r [28] 1833.” [C/P 685]
- Prenanthes crepidinea* Michx.—“*Prenanthes crepidinea* Thicket, [fence corner] near Lex[ingto]n Sep[tembe]r [probably August 31] 1833.” [C/P 659] —“*Prenanthes crepidinea* Thicket, near [Col. Taylor’s], Lex[ingto]n, Aug[ust 30] 1835.” [C/P 888(f)] [PH]
- Rudbeckia laciniata* L.—“*Rudbeckia laciniata* Fence corner, [Fowler’s garden, near] Lex[ingto]n July 1833.” [C/P 618(b)]
- Rudbeckia triloba* L. var. *triloba* —“*Rudbeckia triloba* Dry field near Kent[uck]y river, [Rodgers’] July [19] 1834.” [C/P 799(h)]
- Senecio obovatus* Muhl. ex Willd.—“*Senecio aureus* Banks of Creek, Lex[ingto]n April 1834.” [Also near Rodgers’, April 5, 1834. C/P 724(b)]
- Silphium perfoliatum* L.—“*Silphium perfoliatum* Alluvial banks, Kent[uck]y river, [Elk Lick] Aug[ust 16] 1834.” [C/P 812(t)]

- Solidago altissima* L.—“*Solidago canadensis* R. Peter [writing unfamiliar (R. S.)] [C/P –] [Charles W. Short Herbarium, PH]
- Solidago caesia* L.—“*Solidago axillaris* Bank, Kent[uck]y river, [Rodgers'] Oct[ober 16] 1834.” [C/P 820(f)]
- Solidago canadensis* L. var. *canadensis* —“*Solidago canadensis* Banks, Boon[e]’s Creek, Kent[uck]y river Sep[tembe]r 1834.” [C/P –]
- Solidago flexicaulis* L.—“*Solidago latifolia* Bank, [wood, mouth of Elk Lick], Kent[uck]y river Sep[tembe]r [20] 1834.” [C/P 816(h)]
- Solidago juncea* Ait.—“*Solidago elliptica* ? [epithet in pencil (R. S.)] From Carrington’s peak—Olympian Springs Dr. Peter. C. W. Short, M.D. Lexington, Kentucky Sept[ember] 1835.” [cf. C/P 864 August 10–20 1835] [Charles W. Short Herbarium, PH]
- Solidago rupestris* Raf.—“*Solidago ruprestris* Raf. Rocky banks, Kent[uck]y river, [Rodgers'] Sep[tembe]r [20] 1834.” [C/P 817(c)]
- Solidago ulmifolia* Muhl.—“*Solidago ulmifolia* ? woods, cliffs, Kentucky river [opposite Elk Lick] Aug[ust 16] 1834.” [C/P 812(w)]
- Verbesina occidentalis* (L.) Walt.—“*Verbesina siegisbeckia* Alluvial banks, Kent[uck]y river, [probably near Elk Lick] Sep[tembe]r [20] 1834.” [C/P 817(d)] [Also one specimen in Thomas C. Porter Herbarium, PH]

APPENDIX C

BOTANICAL PUBLICATIONS USED BY ROBERT PETER

BOOKS

This list was compiled from an inventory of Peter’s books found at his home,¹³⁹ from references scattered throughout his notes and correspondence, and from C. W. Short’s *Bibliographia Botanica*,¹⁴⁰ on the premise that books known to Short would have been known to Peter also.

- Barton, Benjamin Smith. 1812–1814. *Elements of botany*: or outlines of the natural history of vegetables, 2d ed. in 2 parts. Philadelphia: published by the author.
- Barton, William Paul Crillon. 1817–1818. *Vegetable materia medica of the United States*; or medical botany: containing a botanical, general, and medical history, of medicinal plants indigenous to the United States, 2 vols. Philadelphia: M. Carey & Son.
- . 1818. *Compendium florae philadelphicae*: containing a description of the indigenous and naturalized plants found within a circuit of ten miles around Philadelphia, 2 vols. Philadelphia: M. Carey & Son.
- . [1820–] 1821–1823 [–1824]. *A flora of North America*. Illustrated by coloured figures, drawn from nature. Philadelphia, 3 vols. Philadelphia: M. Carey & Son [vol. 1]; H. C. Carey & I. Lea [vols. 2, 3].
- Beck, Lewis Caleb. 1833. *Botany of the northern and middle states*; or, a description of the plants found in the United States, north of Virginia, arranged according to the natural system. With a synopsis of the genera according to the Linnæan system—a sketch of the rudiments of botany, and a glossary of terms. Albany: Webster[s] and Skinners.
- Bigelow, Jacob. 1817–1820. *American medical botany*, being a collection of the native medicinal plants of the United States, containing their botanical history and chemical analysis, and properties and uses in medicine, diet and the arts, with coloured engravings, 3 vols. Boston: Cummings and Hilliard.
- . 1824. *Florula bostoniensis*. A collection of plants of Boston and its vicinity, with their generic and specific characters, synonyms, descriptions, places of growth, and time of flowering, and occasional remarks, second edition greatly enlarged. To which is added a glossary of botanical terms employed in the work. Boston: Hilliard & Metcalf.
- Candolle, Augustin Pyramus de. [1817] 1818–1821. *Regni vegetabilis systema naturale*, sive ordines, genera, et species plantarum secundum methodi naturalis normas digestarum et descriptarum, 2 vols. Paris, Strasbourg, London: Treuttel et Würtz.
- . 1823 (–1841). *Prodromus systematis naturalis regni vegetabilis*, sive enumeratio contracta ordinum, generum, specierumque plantarum hucusque cognitarum, juxta methodi naturalis normas digesta. Paris, Strasbourg, London: Treuttel et Würtz. [7 vols.; entire work 17 vols]

- . 1827. *Organographie végétale*, ou description raisonnée des organes des plantes, pour servir de suite et de développement à la théorie élémentaire de la botanique, et d'introduction à la physiologie végétale et à la description de familles, avec 60 planches et taille-douce, 2 vols. Paris: Déterville.
- Darlington, William. 1826. *Florula cestricea*; an essay towards a catalogue of the phaenogamous plants, native and naturalized, growing in the vicinity of the Borough of West-Chester, in Chester County, Pennsylvania.... West-Chester, Pennsylvania: published by Simeon Siegfried for the author.
- Delessert, Jules Paul Benjamin. 1820–1846. *Icones selectae plantarum* quas in systemate universali ex herbariis Parisiensibus, praesertim ex Lessertiano descripsit Augustin Pyramus de Candolle, 5 vols. Paris.
- Eaton, Amos. 1829. *Manual of botany for North America*: Comprising generic and specific descriptions of the indigenous plants and common cultivated exotics growing north of the Gulf of Mexico, 5th ed. Albany: Websters and Skinners.
- . 1833. *Manual of botany for North America*: Comprising generic and specific descriptions of the indigenous plants and common cultivated exotics growing north of the Gulf of Mexico, 6th ed. Albany: Oliver Steele.
- Eaton, Amos, and John Wright. 1840. *North American botany*; comprising the native and common cultivated plants north of Mexico: genera arranged according to the artificial and natural methods. [8th ed. of Eaton's *Manual of botany*...] Troy: Elias Gates.
- Eberle, John. 1818. *Botanical terminology*. Philadelphia: M. Carey & Son.
- . 1822–1823. *A treatise of materia medica and therapeutics*, 2 vols.; 2d ed. 1825; 3d ed. 1830. Philadelphia: James Webster.
- . 1825. *A treatise of materia medica and therapeutics*, 2d ed., 2 vols. Philadelphia: James Webster.
- . 1830. *A treatise of materia medica and therapeutics*, 3d ed., 2 vols. Philadelphia: James Webster.
- . 1836. *A treatise of materia medica and therapeutics*, 4th ed., 2 vols. Philadelphia: Grigg and Elliott.
- Elliott, Stephen. 1821–1824. *A sketch of the botany of South-Carolina and Georgia*, 2 vols. Charleston: J. R. Schenck.
- Gray, Asa. 1834, 1835. *North American Gramineae and Cyperaceae*, parts 1 and 2. New York: J. Post.
- . 1836. *Elements of botany*. New York: G. & C. Carvill & Co.
- Guillemin, Antoine. 1833. *Archives de botanique, ou, Recueil mensuel de mémoires originaux*, d'extraits et analyses bibliographiques, d'annonces et d'avis divers concernant cette science, 2 vols. Paris : Au Bureau des Archives.
- Hildreth, S. P. 1826. Notes on certain parts of the state of Ohio. *Amer. J. Sci.* 10: 319–331, 11: 231–238.
- . 1827. Observations on the climate and productions of Washington County, Ohio. *Amer. J. Sci.* 12: 206–212.
- Hooker, William Jackson. [1829–] 1830–1833. *Botanical miscellany*; containing figures and descriptions of such plants as recommend themselves by their novelty, rarity, or history, or by the uses to which they are applied in the arts, in medicine, and in domestic oeconomy; together with occasional botanical notices and information..., 3 vols. London: John Murray.
- . 1833–1840. *Flora boreali-americae*; or, the botany of the northern parts of British America, 2 vols. London: Treuttel & Würtz.
- Kunth, Carl Sigismund. 1829–1844. *Révision des graminées* publiées dans la Nova genera et species plantarum de Humboldt et Bonpland [issued in 44 fascicles]. Paris: Gide fils.
- Le Bon Jardinier, almanach pour l'année 1844*. Paris: Librairie agricole de la Maison rustique.
- Lindley, John. 1831. *An introduction to the natural system of botany*..., with an appendix by John Torrey, M.D. 1st American ed. New York: G. & C. Carvill.
- . 1832. *An introduction to botany*. London: Longman, Rees, Orme, Brown, and Green.
- Linnaeus, Carl. 1780. *Philosophia botanica*, 2d ed. [revised and emended by Johann Gottlieb Gleditsch] Berlin: C. F. Himburg.
- . *Systema naturae*, sive regna tria naturae systematice proposita per classes, ordines, genera, species... [Doubtless Robert Peter consulted one of the many later editions, but I found no indication which one.]
- Marshall, Humphry. 1785. *Arbustrum americanum*: the American grove, or an alphabetical catalogue of forest trees and shrubs, natives of the American United States, arranged according to the Linnaean system. Philadelphia: Joseph Crukshank.
- Michaux, André. 1803. *Flora boreali-americae*, sistens caracteres plantarum quas in America septentrionali, collegit et detexit Andreas Michaux. . . tabulis aeneis 51 ornata, 2 vols. Paris: Levrault.
- Muhlenberg, Henry. 1813. *Catalogus plantarum Americae septentrionalis*, huc usque cognitarum indigenarum et circum: or A catalogue of the hitherto known native and naturalized plants of North America, arranged according to the sexual system of Linnaeus. Lancaster, Pennsylvania: William Hamilton.

- . 1817. *Descriptio uberior graminum et plantarum calamariarum Americae septentrionalis indigenarum et cicurum*. Philadelphia: Solomon W. Conrad.
- Nuttall, Thomas. 1817. Description of *Collinsia*, a new genus of plants. *J. Acad. Nat. Sci. Philadelphia* 1(8): 189–192.
- . 1818. *The genera of North American Plants*, and a catalogue of the species, to the year 1817, 2 vols. Philadelphia: printed for the author by D. Heartt.
- Pursh, Frederick Traugott. 1814. *Flora Americae septentrionalis*; or, a systematic arrangement and description of the plants of North America, 2 vols. London: White, Cochrane, and Co.
- Rafinesque, Constantin Samuel. 1820. *Annals of nature* or annual synopsis of new genera and species of animals, plants, etc. discovered in North America by C. S. Rafinesque. Lexington: Thomas Smith.
- . 1828. *Medical flora*; or, manual of the medical botany of the United States of North America, 2 vols. Philadelphia: Atkinson and Alexander.
- . 1836 [–1838]. *New flora and botany of North America*, or a supplemental flora, additional to all the botanical works on North America and the United States. Philadelphia: published by the author.
- Riddell, John Leonard. 1834. Botanical specimens. Particular directions for collecting and preserving specimens of plants, extracted from an unpublished treatise on practical botany. *West. J. Med. Phys. Sci.* 8: 18–42.
- . 1835. *A synopsis of the flora of the western states*. Cincinnati: E. Deming.
- Salisbury, William. 1816. *The botanist's companion*, 2 vols. London: Longman, Hurst, Rees, Orme, and Brown.
- Smith, James Edward. 1814. *An introduction to physiological and systematical botany*. "First American, from the second English edition; with notes by Jacob Bigelow, M.D." Philadelphia: Anthony Finley.
- . 1822. *A grammar of botany*. New York: James V. Seaman.
- Torrey, John. 1824. *A flora of the northern and middle sections of the United States*; or, a systematic arrangement and description of all the plants hitherto discovered in the United States, north of Virginia, 3 vols. New York: T. & J. Swords.
- . 1826. *Compendium of the flora of the northern and middle states* containing generic and specific descriptions of all the plants, exclusive of the cryptogamia, hitherto found in the United States, north of the Potomac. New York: Stacy B. Collins.
- Torrey, John, and Asa Gray. 1838–1843. *A flora of North America*, 2 vols. New York: Wiley and Putnam.
- White, Gilbert. 1789. *The natural history and antiquities of Selborne*. London: B. White and Son.
- Willdenow, Carl Ludwig. 1805. *The principles of botany and of vegetable physiology*. Translated from the German of D. C. Willdenow. Edinburgh: University Press.
- . 1809. *Enumeratio plantarum horti regii botanici berolinensis*. Berlin.

JOURNALS

C. W. Short wrote,¹⁴¹ "Numerous detached papers...have been given in separate publications.... Among the contributors of this miscellaneous matter...may be found the names of the Bartons, Bartram, Baldwin, Cooper, Croom, Curtis, Darlington, Dewey, the Eatons, Gray, Greene, Griswold, Gibbes, Houghton, Hossack, James, Leconte, Leavenworth, Loomis, Muhlenberg, Mitchell, Nuttall, Oakes, Pickering, Peter, Rafinesque, Riddell, Schweinitz, Torrey, Short, etc....

"The periodicals of our own country in which botanical communications have been chiefly published, are the *Transactions of the American Philosophical Society*—*The American Journal of Science and Arts*—*The New York Medical Repository*—*The Journal of the Academy of Natural Sciences of Philadelphia*—*The Annals of the New-York Lyceum*—*The Journal of the Boston Society of Natural History*—*The Atlantic Journal*—*The Western Review* (Lexington, Ky.)—*The Western Journal of Medical and Physical Sciences* (Cincinnati, O.)—*The Transylvania Journal of Medicine*, etc. etc."

Robert Peter had access to most of these periodicals.

ENDNOTES

1. At the University of Michigan Herbarium (MICH), accession records from 1930 list 325 Robert Peter specimens (Kaufman 1930). In 1972–78, I was able to locate only 279: 268 from Kentucky, ten from Pittsburgh, and one from New Jersey (an exchange specimen collected by R. E. Griffith, Philadelphia). The missing specimens may have been re-identified and placed in other parts of the Herbarium, or have been out on long-term loan.
2. Riley, 1958, p. 3.
3. The original Transylvania University underwent several moves, mergers, and separations. Both the present Transylvania University and the University of Kentucky originated in that school.
- 4 Unless specifically noted otherwise, the following synopsis of Peter's life is a synthesis of facts derived from: Coker, 1941; Kelley, 1912; Kelley & Burrage, 1928; Meijer, 1973; Meisel, 1967; Peter Papers, 1828–1905, Statement of Holdings; Peter, 1882; Snow, 1954; Todd & Woody, 1894; Who Was Who..., 1963; and Wilson & Fiske, 1888.
5. Peattie, 1936.
6. Meisel, 1924, 1967.
7. Peter Papers, 1828–1905, Statement of Holdings.
8. Kelley, 1912, p. 268.
9. Peter, 1828–1835.
10. J. Bauer, 1976; Rensselaer School Exercises, 1828.
11. Rensselaer Catalogue, 1828.
12. Nason, 1887, p. 600.
13. Wright, 1955, p. 4.
- 13b. Ibid.
14. Ibid., p. 7.
15. Payne & Anderson, 1962, pp. 155–156.
16. Ibid, p. 155.
17. Evans Papers, 72M15, Box 3, Folder 37.
18. Rensselaer Exercises, 1828, pp. 40–43.
19. Anon., 1837, p. 3.
20. Wright, 1955, p. 7.
21. Payne & Anderson, 1962, pp. 152–153.
22. Davies, 1945, p. 145.
23. McVaugh, 1978.
- 24 Wright, 1955, p. 7.
25. Wilson & Fiske, 1888, p. 407.
26. Wright, 1955, p. 15.
27. Meisel, 1924, p. 222.
- 28 Peter, 1828, January 23. Letters to Robert Peter, 1820–1854, MSC 13, 1820 folder.
29. Peter, 1828, February 9. As above.
30. Amos Eaton, 1829.
31. Economy is now Ambridge, Pennsylvania.
32. Schweinitz, 1831.
33. Gerber, 1927, pp. 280–281.
34. See Appendix B.
35. Shnabel, 1828.
36. Payne, 1942, p. 89.
37. Durand, 1829, March 8; and Dubarry, 1829, March 8.
38. Durand, 1829, April 2.
39. Evans Papers, 72M15, Box 3.
40. Shnabel, 1829.
41. Hitchcock, 1829.
42. Hildreth, 1829.
43. Gibbons, 1831.
44. Peter, 1905, p. 89.
45. Peter, 1833, April 14.
46. Wright, 1955, pp. 23–24.
47. Snow, 1954, p. 2.
48. Eaton, H., 1832.
49. Davies, 1945, p. 133.
50. Peter, 1834.
51. Evans Papers, 72M15, Box 3, #37.
52. Davies, 1945, pp. 141–142.
53. Davies, 1945, p. 145. See also Short & Eaton, 1831.
54. Ibid., p. 145.
55. Ibid, p. 153.
56. See Appendix A.
57. Davies, 1945, p. 147.
58. Ibid., 145–146.
59. A facsimile edition of these publications is owned by the Herbarium of the University of Michigan.
60. Ibid.
61. Short, 1828, p. 99.
62. Peter's spelling of this name varied: sometimes *Rodgers*, at others *Rogers*. I used *Rodgers*, except in direct quotations.
63. Peter's manuscript "Catalogue of plants.."
64. Short & Peter, 1834.
65. Fernald, 1950, p. 1403.
66. Peter, ms. "Catalogue," 1828–1835, p. 100.
67. Ibid., pp. 100, 123–124.
68. Ibid., pp. 83–84.
69. Fernald, 1950, p. 624.
70. Short & Peter, 1834, p. 598.
71. Peter, ms. "Catalogue," 1828–1835, p. 103.
72. Short & Peter, 1834, p. 600.
73. Gleason, 1952, v. 2, p. 126.
74. Short & Peter, 1834, p. 600.
75. Peter, ms. "Catalogue," 1828–1835, p. 120.
76. See also Peter's "Notice of the Crab Orchard Mineral Springs," 1835, 8:408–414.
77. Snow, 1954, p. 2.
78. Wright, 1955, bibliography.
79. See a pencil-written list, "Articles in the Farmer's Home Journal. Evans papers, 72M15, Folder #15.
80. Owned by the Special Collections Department, Transylvania University Library, Lexington, Kentucky.

81. Peter, 1820–1854. List of mss. letters, in Box 1820–1854, folder marked 1820.
- 81b. Durand, 1833.
82. Peck, 1834.
83. Durand, 1834, August 1.
84. Rafinesque, 1834.
85. Durand, 1834, September 2.
86. Peter, 1835, June 29.
87. Van Cleve, 1835, August 18.
88. Peter, 1835, October 11.
89. Peter, 1835, Nov. 5.
90. Peter, 1836, January 10.
91. Gray, 1838, July 31.
92. Gray, 1852, January 17.
93. Willis, 1966.
94. Parker, 1835, May 12.
95. I was unable to identify Mr. Wilson further.
96. Hooker, 1836, November 5.
97. Peter, 1837, August 11.
98. Marshall, 1838, April 21.
99. Now the Galena River, Illinois.
100. Sulphur strontianite, SrCO_3 , according to Devin O'Dell, student assistant at the A. E. Seaman Mineral Museum, Michigan Technological University, Houghton, Michigan.
- 101 Houghton, 1835, Feb. 2.
102. The specimens that Houghton was offering to Peter must have come from one of the two Schoolcraft expeditions to the Indians and to find the source of the Mississippi, as well as from the vicinity of Detroit. The first Michigan Geological Survey was not begun until 1837. See McVaugh, 1970, pp. 214–215, and Voss, 1978, pp. 16–28.
103. Houghton, 1835, September 5.
104. McHargue, 1928, p. 153; A. M. Peter, 1942.
105. McFarland, 1924.
106. Riley, 1958.
107. Ibid., p. 2.
108. A. M. Peter, 1992 (1877–1940).
- 108b. Stevens, 1984.
109. Davies, 1953, p. 51.
110. Peter, 1828–1835 (1838), labels on specimens in the Herbarium of the Academy of Natural Sciences of Philadelphia, Pennsylvania.
111. Peter, 1833–1834, labels on specimens in Herbarium of the New York Botanical Garden, Bronx, New York. No additional specimens were reported by Holmgren (1975) or Kallunki (1992).
112. Peter, 1834, labels on specimens in the Herbarium of the U.S. National Arboretum, Washington, D.C.
- 112b. At least one of these was verified by Fogarasi, 1979.
113. During his painstaking research on Dr. Charles W. Short, Dr. Ronald Stuckey copied label data from such Peter specimens as he encountered, and that information has been added to Appendix B. There may well be more of Peter's plants in these herbaria.
114. Bamps, 1993.
115. Kittredge, 2000.
116. Clokie, 1964, p. 223.
117. Hedge & Lamond, 1970, p. 118.
118. Noltie, 1993. See *Potamogetan natans* in Appendix B, from the Herbarium of the University of Glasgow.
119. O'Connor, 2000.
120. Nelson, 1980, was the source for the reference to R. Peter in Vegter, 1983. Nelson wrote, "The inclusion of a collector in this catalogue indicates that *at least one* specimen collected by that person is in DBN [the Herbarium of the Irish National Botanic Gardens, Glasnevin, Dublin]; it does not imply that there is *more than one* specimen (p. 38)."
121. Fox, 2000.
122. Russell, 1992.
123. Vegter, 1983.
124. Guerlesquin, 1992.
125. Thompson, 1992.
126. Danielson, 1992.
127. Coover, 2000. (The Dayton Museum of Natural History has been renamed the Boonshoft Museum of Discovery.)
128. Thijsse, 1993.
129. Wilkins, 1993.
130. Sieren, 1992.
131. Landry, 1992.
132. Potvin, 1992.
133. Gunn, 1980.
134. Stuckey, 1992.
135. Stuckey, 1971.
136. Piggott, 1992.
137. Peter, 1836, October 17.
138. Peter, A. M., 1942.
139. Peter, R., n.d., ca. 1894. An inventory of his books at Winton (his home in later years). Box 17, Evans Papers.
140. Short, *Bibliographia Botanica*, 1835.
141. Ibid, pp. 556–557.

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| <i>Frankfort East</i> , 1953–70 | <i>Paris West</i> , 1954. |
| <i>Georgetown</i> , 1965. | <i>Richmond North</i> , 1965. |
| <i>Irvine</i> , 1952. | <i>Versailles</i> , 1965. |
| <i>Lexington East</i> , 1965–1971. | <i>Williamstown</i> , 1961. |

ADDITIONS TO THE CAREX LURIDA GROUP (CYPERACEAE) IN MEXICO, INCLUDING A NEW SPECIES FROM CHIAPAS

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ABSTRACT. *Carex longiligula* is described from Chiapas, Mexico, as a new species in the *C. lurida* group. It differs from *C. durangensis*, the species most similar to it, in having much longer ligules on the main stem leaves, conspicuously ciliate pistillate and staminate scale bodies, narrower perigynia, and narrower achenes. The description of *C. durangensis*, compiled only from the holotype, is expanded based on several recent collections, and *C. lurida* is reported as new to the Flora Mesoamericana region based on a collection from Chiapas.

The *Carex lurida* group (section *Vesicariae*), as recently revised by Reznicek and González-Elizondo (1995), had six species: two in eastern North America, *C. baileyi* Britton and *C. lurida* Wahlenb., with *C. lurida* also occurring in Mexico, the Caribbean, and northern South America; two endemic species in Mexico, *C. durangensis* Reznicek & S. González and *C. rzedowskii* Reznicek & S. González; and two endemic species in Andean South America, *C. luridiformis* Mack. ex Reznicek & S. González and *C. setigluma* Reznicek & S. González. Recent field work in Chiapas and Durango has greatly expanded our knowledge of the *Carex lurida* group in Mexico and included the discovery in Chiapas of a new species, similar to *C. durangensis* in general aspect. The new species is described below as *C. longiligula*. In addition, *C. durangensis*, described only from the holotype, has now been found at several additional localities in Durango. An amplified description is included to reflect new information provided by these discoveries. As well, *C. lurida*, known previously in Mexico only from a few sites on the Caribbean slope in Hidalgo and Veracruz, was discovered in Chiapas, a significant range extension and an addition to the Flora Mesoamericana region.

Carex longiligula Reznicek & S. González, sp. nov.—**TYPE:** MEXICO. Chiapas: Mpio. Tenejapa, along the road to Matzam, 2.3 km from the jct. with the San Cristóbal de las Casas–Tenejapa road, 16°46'51"N, 92°32'01"W, 11 Jul 1997, S. González & A. A. Reznicek 10506, M. González, M. Pinedo (holotype: MICH!; isotypes to be distributed).

Plantae cespitosae, rhizoma lignosum; culmi fertiles 35–68 cm alti; vaginae basales atropurpureae, glabrae. Folia 4–7, laminae 9–60 cm longae, 5–8 mm latae, folia superiora culmo longiora; vaginae glabrae, ventraliter albido- vel pallido-brunneae; ligulae foliorum principalium 25–38 mm longae. Inflorescentiae (5–) 7–17

cm longae, spicae (3-) 4-5; bracteae infimae laminis 8-36 cm longis, 2.8-5 mm latis; spica terminalis omnino staminata, (2.8-) 3.8-4.9 cm longa, 3.1-4 mm lata, pedunculo 2-8 mm longo; spicae laterales (2-) 3-4, pistillatae, (2-) 3-4.3 cm longae, 8-12 mm latae, floribus (80-) 150-320 dense imbricatis. Squamae staminatae 5.3-11.3 (-25.4) mm longae, corporibus 3.5-5.6 mm longis, 1-1.5 (-1.7) mm latis, ciliatis, aristatae, aristis (0.4-) 1.1-7.8 (-22) mm longis. Squamae pistillatae 2.8-10.4 mm longae, corporibus 1.8-3 mm longis, 0.8-1.4 mm latis, ciliatis, aristatae, aristis 0.8-7.8 mm longis. Perigynia 4.7-5.4 mm longa, 1.7-1.9 mm lata, inflata, glabra, corporibus biconvexis vel suborbiculatis in rostrum (1.8-) 2.1-2.5 (-2.8) mm longum contracta. Achenia ca. 2-2.4 mm longa, 0.8-1.1 mm lata, trigona. Styli persistentes; stigmata 3. Antherae 3, ca. 1.3-2.1 mm longae.

Cespitose from stout, woody rhizomes up to 6 mm wide, the rhizomes ca. 0.8-3.5 cm long between shoots; fertile culms 35-68 cm tall, erect, trigonous, prominently angled, almost winged, antrorsely scabrous, 1-1.5 mm wide immediately below the inflorescence; bladeless basal sheaths dark purple, somewhat fibrillous with age. Leaves 4-7, distributed over the lower 4/5 of the culm; blades 9-60 cm long, 5-8 mm wide, the uppermost surpassing the inflorescence, flat to conduplicate, the margins and midrib antrorsely scabrous distally; leaf sheaths glabrous, dorsally septate-nodulose, ventrally whitish or pale brown, somewhat hyaline distally, thin, concave at the apex; ligules (0.8-) 15-38 mm long, those of the lower leaves and vegetative shoot leaves 25-38 mm long, long-acute, the free portion brownish, 0.2-0.4 mm wide. Inflorescences (5-) 7-17 cm long, 2-3.8 cm wide, with (3-) 4-5 spikes, the terminal staminate, laterals pistillate or rarely one or two with a few staminate flowers at the apex; pistillate spikes approximate or the lower separated by up to 12.5 cm, erect, nearly sessile or the lowermost on a peduncle up to 2.9 cm long; lowermost 1-3 bracts foliaceous, 8-36 cm long, 2.8-5 mm wide, antrorsely scabrous along the margin and midvein or distally on all the veins, proximally slightly septate-nodulose, sheathless or with a short sheath up to 17 mm long, the upper bracts reduced. Staminate spike (2.8-) 3.8-4.9 cm long, 3.1-4 mm wide, linear-cylindric, on a smooth peduncle 2-8 mm long. Pistillate spikes (2-) 3-4.3 cm long, 8-12 mm wide, cylindric, densely flowered with about (80-) 150-320 ascending-spreading perigynia in several to many rows. Staminate scales 5.3-11.3 (-25.5) mm long, the body 3.5-5.6 mm long, 1-1.5 (-1.7) mm wide, oblan-ceolate to linear-oblong, stramineous to brownish or purple with a green, 3-nerved center, margins ciliate in the upper 1/3-1/2, acute, the midrib prolonged into a rough awn (0.4-) 1.1-7.8 (-22) mm long, the awn (0.1-) 0.3-6.5 times as long as the body. Pistillate scales 2.8-10.4 mm long, the body 1.8-3 mm long, 0.8-1.4 mm wide, ovate to oblong, stramineous to purple-red with a green, 3-nerved center, margins ciliate in the upper 1/3-1/2, acute, the midrib prolonged into a rough awn 0.8-7.8 mm long, the awn 0.7-2.7 times as long as the body. Perigynia 4.7-5.4 mm long, 1.7-1.9 mm wide, inflated, biconvex to suborbicular in cross section, cellular-membranaceous, glabrous, greenish to pale brown or dark purple, shiny, 6-10-nerved with 2 (-3) nerves more or less evident and extending into the beak, the rest faint, sessile or short-pedicellate, contracted into a beak; beak (1.8-) 2.1-2.5 (-2.8) mm long, ca. 0.6-0.8 (-1) times as long as the body, smooth, cylindrical, slender, green to stramineous or purple-tinged, the apex bidentate with erect teeth 0.4-0.7 mm long. Achenes 2-2.4 mm long, 0.8-1.1 mm wide, trigonous with convex sides above, narrowly obovoid to ellipsoid, often with one angle curved to indented, papillose, pale yellowish brown, stipitate, at the apex tapering and continuous into the persistent, contorted style; stigmas 3. Anthers 3, ca. 1.3-2.1 mm long.

Carex longiligula is known only from the type locality in Chiapas, where it was rare in several large, wide patches in openings and at the edges of a *Schoenoplectus californicus* marsh along a small, clear stream at 2400 m.

This species is similar to *C. durangensis* in its wide leaves and general aspect and would key to it, admittedly somewhat imperfectly because of its narrower achenes, in Reznicek and González (1995); however, it is a leafier, somewhat more slender plant forming looser, wider clumps. It differs most strikingly in its longer ligules (25–38 mm on the main stem leaves versus 12–22 mm), longer staminate scale awns [(0.4–) 1.1–7.8 (–22) mm versus 0.2–1.5 (–5.4) mm], pistillate and staminate scales ciliate on the upper 1/3–1/2 of the body versus erose-ciliate only near the base of the awn, narrower perigynia [1.7–1.9 mm versus (1.7–) 1.9–2.2 mm], and narrower achenes (0.8–1.1 mm versus 1.1–1.4 mm). Additional differences are provided in Table 1.

The relatively narrow, indented achenes also might suggest a relationship with the South American species of this group, especially *C. setigluma*, with smaller perigynia and long-awned scales; however, the ciliate scale bodies and extremely long ligules of *C. longiligula* are both unique within the *C. lurida* group. *Carex longiligula* also differs from *C. setigluma* in having longer pistillate scale bodies, 1.8–3 mm long and clearly visible in the spike, and wider achenes, 0.8–1.1 mm wide. *Carex setigluma* has pistillate scales with tiny bodies 1.1–1.7 mm long, which are totally concealed in the spikes by the perigynium bodies, leaving only the awns visible, and narrower achenes, 0.6–0.8 mm wide. *Carex luridiformis* differs additionally in having large perigynium bodies, with the beaks less than half the length of the bodies (beak/body ratio 0.4–0.5); *C. longiligula* has proportionately much shorter bodies [beak/body ratio 0.6–0.8 (–1)].

Carex durangensis Reznicek & S. González, Contr. Univ. Michigan Herb. 20: 220. 1995.—TYPE: MEXICO. Durango: 7 mi SW of El Salto, 11 Jul 1970, *Fitzner* 262 (holotype: MSC!).

Cespitose from stout, woody rhizomes up to 6 mm wide, the rhizomes ca. 0.3–2.5 mm long between shoots; fertile culms 24–65 cm tall, erect, trigonous, prominently angled, smooth or antrorsely scabrous, (1.2–) 1.5–1.8 mm wide immediately below the inflorescence; bladeless basal sheaths brown with purple tingeing to red-purple, somewhat fibrillous with age. Leaves 4–7, mostly on the lower 2/3 of the culm; blades 5–25 (–31) cm long, 5–10 mm wide, the uppermost surpassing the inflorescence, flat, the margins and midrib antrorsely scabrous distally; leaf sheaths glabrous, very slightly septate-nodulose dorsally, whitish or pale brown, somewhat hyaline at the upper part ventrally, thin, truncate or slightly concave or convex at the apex; ligules (6–) 12–22 mm long, acute, the free portion brownish, 0.2–0.4 mm wide. Inflorescences (2.8–) 5–11 cm long, 2–3.5 cm wide, with 3–4 (–5) spikes, terminal staminate, lateral pistillate or rarely one with a few staminate flowers at the apex; pistillate spikes approximate or the lower separate, erect, nearly sessile or the lowermost on a peduncle up to 2 cm long; lowermost 1–3 bracts foliaceous, 10–26 cm long, 4.4–8.4 mm wide, antrorsely scabrous along the margin and midvein or distally on all the veins, sheathless or with a short sheath up to 15 (–45) mm long, the upper bracts reduced. Staminate spike 1.2–4.8 cm long, (1.9–) 3.1–4 mm wide, linear-cylindric, on a smooth peduncle 2–8 mm long. Pistillate spikes 2.2–4.3 cm long, 9–11 mm wide, cylindric, densely flowered with about 170–300 ascending-spreading perigynia in several to many rows. Staminate

TABLE 1. Contrasting characters of *Carex durangensis* and *C. longiligula*.

CHARACTER	<i>C. durangensis</i>	<i>C. longiligula</i>
Culm angles	acute	almost winged
Leaf blade length (fertile culms) (cm)	5–25 (–31)	9–60
Ligule length of lower stem leaves (mm)	12–22	25–38
Inflorescence length (cm)	(2.8–) 5–11	(5–) 7–17
Spike number	3–4 (–5)	(3–) 4–5
Lowermost bract width (mm)	4.4–8.4	2.8–5
Staminate scale width (mm)	1.4–2	1–1.5 (–1.7)
Staminate scale awn length (mm)	0.2–1.5 (–5.4)	(0.4–) 1.1–7.8 (–22)
Staminate scale awn/body length ratio	0.05–0.4	(0.1–) 0.3–6
Pistillate scale width (mm)	1.2–1.6	0.8–1.4
Scale body margin	entire except at base of awn, where erose-ciliate	ciliate along upper 1/3–1/2 of the body
Perigynium width (mm)	(1.7–) 1.9–2.2	1.7–1.9
Perigynium beak length (mm)	1.7–2.3	(1.8–) 2.1–2.5 (–2.8)
Beak/body length ratio	0.5–0.7	0.6–0.8 (–1)
Achene width (mm)	1.1–1.4	0.8–1.1
Achene shape	obovoid, not indented	narrowly obovoid to ellipsoid, usually indented on one angle

scales 4.3–5.8 (–9.4) mm long, the body 3.5–5 mm long, 1.4–2 mm wide, obovate to oblanceolate, brownish to purple with a green, 3-nerved center, erose-ciliate apically or at the base of the awn, acute or the midrib prolonged into a rough awn 0.2–1.5 (–5.4) mm long, the awn 0.05–0.4 (–1.1) times as long as the body. Pistillate scales 2.8–7 mm long, the body 1.7–2.5 mm long, 1.2–1.6 mm wide, ovate to oblong, whitish to purple-red with a green, 3-nerved center, the upper margin ciliate, truncate to acute, the midrib prolonged into a rough awn 1.1–5.5 mm long, the awn 0.7–2.5 times as long as the body. Perigynia ca. 4.5–5.5 mm long, (1.7–) 1.9–2.2 mm wide, inflated, biconvex to suborbicular in cross section, cellular-membranaceous, glabrous, greenish to brown or reddish brown, somewhat shiny, 6–10-nerved with 2 nerves more or less prominent and extending into the beak and the rest very faint, sessile or short-pedicellate, contracted into a beak; beak 1.7–2.3 mm long, ca. 0.5–0.7 times as long as the body, smooth, cylindrical, slender, green to stramineous, the apex sometimes purple, obliquely cut or bidentate with erect teeth 0.1–0.7 mm long. Achenes 2.1–2.4 mm long, 1.1–1.4 mm wide, trigonous with convex sides above, obovoid, papillose, whitish to yellowish brown, stipitate, at the apex tapering and continuous into the persistent, contorted style; stigmas 3. Anthers 3, ca. 1.6–2.3 mm long.

The holotype of *C. durangensis* proved to be a large, but relatively typical individual. The emended description provides adequate ranges for many features based on several ample recent collections. This quite local species of specialized habitats is now known from a few localities in Durango at 2500–2700 m, in wet

meadows and especially along moist banks of streams. *Carex durangensis* is uncommon in such habitats, but often widespread in small patches.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** DURANGO: Mpio. Canelas, Las Cebollitas, 2460 m, bosque mixto de coníferas, presencia de *Abies*, *Pinus*, *Picea*, *Cupressus* y *Pseudotsuga*, 1 Aug 1990, A. Benítez 1720 (IEB); 10 km SW of El Salto, 1 km NE of Lechería (ca. Km 110 on Hwy 40), 2620 m, 23°45'36"N, 105°26'19" W, wet meadow dominated by *Carex*, *Juncus*, *Eleocharis*, etc., in flat-bottomed valley of small stream, 17 Jul 1996. S. González & A. A. Reznicek 10307 (CIIDIR, IEB, MICH, MEXU); Mpio. Pueblo Nuevo, ca. 3.4 km S of El Salto, along road to Santa Bárbara, 2560 m, 23°44'56"N, 105°23'05"W, stream bank with *Eleocharis*, *Juncus*, and *Senecio billieturneri* in flat-bottomed valley in open *Pinus cooperi* forest, 24 Jun 2000, S. González & A. A. Reznicek 11148 (CIIDIR, MICH); Mpio. Pueblo Nuevo, ca. 2.5 km S of El Salto, along road to Santa Bárbara, 2550 m, 23°45'14"N, 105°22'50"W, marshy stream bank with *Senecio billieturneri*, *Scirpus microcarpus*, *Sparganium*, *Juncus*, and *Carex* in flat-bottomed valley in open *Pinus cooperi* forest, 24 Jun 2000, S. González & A. A. Reznicek 11153 (CIIDIR, MICH).

Carex lurida Wahlenb., Kongl. Vetensk. Acad. Nya Handl. 24: 153. 1803.—TYPE: "America septentrionali," *Hultgren s.n.* (holotype: not located).

The collection cited below represents the first record of this species from southern Mexico and from the Flora Mesoamericana region (Chater 1994). *Carex lurida* grew in a depressional marsh dominated by *Juncus*, *Carex*, *Typha*, and *Osmunda regalis*. The species was abundant at this site, in fact one of the main dominants, but was not seen in similar habitats in the general vicinity.

SPECIMENS EXAMINED. **Mexico.** CHIAPAS: along road between San Andrés Larrainzar and Puerto Cato, 2060 m, 16°53'15"N, 92°43'35"W, 12 Jul 1997, S. González & A. A. Reznicek 10510 (CIIDIR, IEB, MICH).

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CAREX SECTION POROCYSTIS (CYPERACEAE) IN MEXICO AND CENTRAL AMERICA

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ABSTRACT. *Carex* section *Porocystis* is a small, mostly New World section. Two species have long been known from Mexico and Guatemala; one, *C. complanata*, disjunct from the southeastern United States, and another, *C. boliviensis*, disjunct from Andean South America. Study of numerous recent collections disclosed that *C. complanata* in Mexico and Guatemala is represented by an endemic subspecies, subsp. *tropicalis*, differing from temperate North American subsp. *complanata* in its broader pistillate and staminate scales, and generally shorter awned pistillate scales. *Carex boliviensis* is represented in Mexico by two geographically separated subspecies: subsp. *boliviensis* of the Transvolcanic Belt and the Eastern Cordillera in central Mexico, and the more northern and western subsp. *occidentalis*. The latter is larger than subsp. *boliviensis*, has longer inflorescences, and especially longer terminal spikes with longer staminate portions. *Carex angustispica*, a localized endemic with blunt, broad, pistillate scales, short achenes, and narrow spikes is newly described. It occurs in subalpine habitats in the state of Oaxaca and is related to *C. complanata*.

INTRODUCTION

Carex sect. *Porocystis* Dumort. (subg. *Carex*) is a small, primarily North American section of loosely to densely cespitose, small species, with the sheaths and sometimes also the leaves, culms, and perigynia pubescent. The inflorescences have essentially sheathless bracts, leaf-like or not, and densely flowered spikes with the terminal spike usually gynaeandrous or uncommonly staminate. The perigynia are beakless or very short-beaked with an essentially entire orifice. Eight species, *C. bushii*, *C. caroliniana*, *C. complanata*, *C. hirsutella*, *C. pallescens*, *C. swanii*, *C. torreyi*, and *C. virescens*, occur in North America, north of Mexico. One of these, *C. pallescens*, also occurs in Eurasia. Two species, *C. boliviensis* and *C. towarensis*, occur in South America (Reznicek & Wheeler 1993).

Since Hermann's (1974) study of *Carex* in Mexico and Central America, a great deal of new material has accumulated, enough to allow a thorough systematic analysis of sect. *Porocystis* as it occurs in Mexico. Hermann recognized two Mexican species in sect. *Porocystis* (under sect. *Virescentes*). The primarily South American *C. boliviensis* was recorded from Durango, Guerrero, Puebla, and the Valley of Mexico. The southeastern North American *C. complanata* was recorded from Chiapas, the first record of this species from the tropics. We describe here a third, *C. angustispicata*, from Oaxaca. The following key separates all Mexican members of sect. *Porocystis* and *C. complanata* subsp. *complanata* from the southeastern United States.

1. Larger perigynia 2.5–4.1 (–4.6) mm long, widest at 1.4–2.3 mm below apex; pistillate scales obtuse to acute, rarely with a minute mucro to 0.1 mm long; culms more or less flexuous, 0.2–0.65 (–0.85) mm wide ca. 1 cm below the inflorescence; plants loosely cespitose, rhizomes ca. (0.3–) 0.5–2 (–4) cm long between shoots; lateral spikes pistillate or gynaeandrous.
2. Longest terminal spikes 8–17 mm long, the staminate portion usually less than half the length of the spike; the lowest bract often shorter than or about equaling the inflorescence, rarely longer; inflorescences 1.1–2.6 (–3.2) cm long.

C. boliviensis subsp. *boliviensis*.

2. Longest terminal spikes 15–30 mm long, the staminate portion often half the length of the spike or longer; the lowest bract often longer than the inflorescence; longest inflorescences 2.5–6.1 cm long.

C. boliviensis subsp. *occidentalis*.

1. Larger perigynia 2.1–2.8 mm long, widest at 1.1–1.5 mm below apex; pistillate scales obtuse to acuminate, often minutely cuspidate or short-awned; culms stiff, straight or arched, (0.4–) 0.5–1.2 mm wide ca. 1 cm below the inflorescence; plants densely cespitose, rhizomes rarely more than 0.5 cm long between shoots; lateral spikes pistillate.
3. Pistillate scales 1.2–1.6 times as long as wide, obtuse to acute, sometimes minutely cuspidate; achenes 1.4–1.8 mm long; pistillate portion of terminal spikes 2.8–5.1 mm wide.

C. angustispica.

3. Pistillate scales 1.6–3.3 times as long as wide, obtuse to acuminate-awned, at least some scales with an awn 0.1–0.9 mm long; achenes 1.7–2.2 mm long; pistillate portions of terminal spikes (4.4–) 4.8–7.3 mm wide.

4. Scales from the middle of the staminate portion of the terminal spikes 1.8–2.9 (–3.1) times as long as wide, (1–) 1.2–1.6 (–1.8) mm wide; scales from the middle of the pistillate portions of the spikes 1.3–2.5 times as long as wide, the longest awns 0.1–0.5 (–0.8) mm long.

C. complanata subsp. *tropicalis*.

4. Scales from the middle of the staminate portion of the terminal spikes (2.2–) 2.7–5 times as long as wide, 0.9–1.5 mm wide; scales from the middle of the pistillate portions of the spikes (1.9–) 2.3–3.3 times as long as wide, the longest awns 0.3–0.9 mm long.

C. complanata subsp. *complanata*.

CAREX BOLIVIENSIS

Carex boliviensis consists of two geographically separated entities differing consistently by several overlapping characters. Plants from the Transvolcanic Belt, and the Eastern Cordillera in central Mexico, have the inflorescences 1.1–2.6 (–3.2) cm long with terminal spikes (6–) 8–17 mm long, the staminate portion usually less than half the length of the spike, and the lowest inflorescence bracts shorter than or about equaling the inflorescence (rarely longer). These plants appear to be essentially identical with those from the South American range of the species. Plants of the Western Cordillera from Chihuahua south to Guerrero have the inflorescences (1–) 2.5–6.1 cm long with terminal spikes (9–) 15–30 mm long, the staminate portion often half the length of the spike or longer, and the lowest bracts often longer than the inflorescence (Fig. 1).

In addition, *C. boliviensis* in the Western Cordillera also differs from those elsewhere in being a generally larger and more robust plant that can have longer culms (up to 87 cm), which are more scabrous- or ciliate-angled. The culms are also sometimes more erect and less flexuous. The perigynia, scales, achenes, and anthers also tend to be longer, and the basal sheaths are often purple or purple-tinged to a greater extent than is typical for *C. boliviensis*. All the characters separating these two entities, however, overlap to a greater or lesser degree, and recognition of these two entities as geographical subspecies seems most appropriate, although robust plants from the Western Cordillera are quite strikingly different.

Loosely cespitose from hard, ascendent, branched rhizomes, the rhizomes ca. (0.3–) 0.5–2 (–4) cm long between shoots; fertile culms (3–) 8–87 cm long, at maturity erect, decumbent, or prostrate, usually much longer than the leaves, wiry and flexuous or not so, trigonous, 0.2–0.65 (–0.85) mm wide ca. 1 cm below the inflorescence, the angles acute, prominent, scabrous to ciliate; bladeless basal sheaths yellowish brown to red or dark purple, soon ruptured and fibrillous. Leaves 5–10, mostly on the lower 1/3 to 1/8 of the culms, occasionally one present a few centimeters below the inflorescence; blades 3.5–25 cm long, 0.8–3.8 mm wide, flat to conduplicate, pubescent basally or almost glabrous, scabrous to ciliate on margins and occasionally on the main veins; leaf sheaths 1–15 cm long, tight, dorsally pubescent or glabrous, green, the inner band membranaceous, pubescent to nearly glabrous, stramineous to pale brown, sometimes red- or brown-dotted, hyaline and easily ruptured, concave to truncate, ciliate at apex; ligules rounded to acute, 0.6–3.7 (–4.6) mm long, the free portion ciliate, 0.1–0.3 (–0.4) mm wide, whitish to brownish. Inflorescences (1–) 2.5–6.1 cm long, spikes (1–) 2–4, overlapping or the

lowermost separated up to 3 cm, single at nodes, sessile or the lowermost sometimes on a filiform peduncle up to 12 mm long; a single pistillate spike is occasionally present on a filiform (0.2 mm wide) ciliate basal culm; the lowest bracts $\pm$ scalelike to filiform-triangular to foliaceous, scabrous distally, 0.25–8.5 cm long, 0.1–1.6 mm wide, shorter or longer than the inflorescence, sheathless or with a sheath 1–5 mm long, the upper bracts reduced, scalelike and sometimes awned; terminal spike gynaeceandrous, (6–) 8–30 mm long, with an ovoid to cylindrical distal pistillate portion 4.5–16 mm long and 3.5–6 mm wide, 6–45-flowered, the staminate portion 2–22 mm long, 1.5–2.5 mm wide, 3–45-flowered, cylindric-obconic to turbinate; lateral spikes pistillate or gynaeceandrous, 5–15 mm long, 3.5–6 mm wide, ovoid to cylindrical, with 6 to 35 (–50) perigynia. Pistillate scales 1.7–3.4 mm long, 1.1–2 (–2.2) mm wide, 1.2–2.2 times as long as wide, ovate to ovate-lanceolate, obtuse to acute, rarely with a minute mucro to 0.1 mm long, glabrous (rarely minutely scabrous), stramineous to brown or purple with a green or stramineous 3-nerved center and usually with narrow hyaline margins and apex; staminate scales 2.7–4.8 mm long, 1.2–2.3 mm wide, 1.7–3.2 times as long as wide, lanceolate to obovate, acute, stramineous to brown or purple with a green or stramineous 3-nerved center and narrow hyaline margins, glabrous or sparsely pubescent. Perigynia 2.2–4.1 (–4.6) mm long, 1.4–1.75 mm wide, widest at 1.4–2.3 mm below apex, ascending, trigonous to flattened-triangular with elliptic to rhombic-ovate sides, glabrous, firm-membranous, scarcely inflated, green to pale brown, sometimes red-dotted, faintly 6–16-nerved or with some nerves prominent, conically tapered to a truncate, entire, minutely erose, or emarginate apex; beak absent. Achenes 1.6–2.6 mm long, 1.1–1.5 mm wide, trigonous, ovoid, ellipsoid, or obovoid, brown with paler, yellowish angles, minutely puncticulate, pedicellate and apiculate. Style straight, withering; stigmas 3. Anthers 3, 1.4–2.3 mm long.

***Carex boliviensis* var. *boliviensis*.**

Carex galbana L. H. Bailey, Bot. Gaz. (Crawfordsville) 25: 271. 1898.—TYPE: MEXICO. México: Sierra de las Cruces, 13 Aug 1896, *Pringle* 7083 (holotype: BH!; isotypes: ENCB! MEXU-2! US! VT!).

Culms 3–64 cm tall, wiry, flexuous, decumbent or prostrate, 0.2–0.5 (–0.75) mm wide at ca. 1 cm below the inflorescence, finely scabrous-angled; bladeless basal sheaths yellowish brown or only little red-tinged. Inflorescences 1.1–2.6 (–3.2) mm long, the lowest bracts little more than an awned scale to filiform-triangular, 0.25–3 cm long, usually shorter than to equaling the inflorescence; terminal spikes (6–) 8–17 mm long, the staminate portion 1–4.5 mm long, usually less than half the length of the spike. Pistillate scales 1.8–2.3 mm long; staminate scales 2.7–3.1 (–3.7) mm long. Perigynia 2.2–3.2 (–3.4) mm long. Achenes 1.6–2.2 mm long. Anthers 1.4–2.1 mm long.

Carex boliviensis var. *boliviensis* is known from central and southern Mexico, and in South America from Peru south to northern Argentina. In Mexico it occurs in alpine to subalpine sites, usually in swampy areas and along streambanks, but sometimes in drier meadows between 2700 and 3940 m (Fig. 3). In South America it grows at elevations up to 4100 m. Fruiting occurs from June to October.

REPRESENTATIVE SPECIMENS. **Mexico.** DISTRITO FEDERAL: Puerto de Las Cruces, Deleg. Cuajimalpa, 24 Jun 1973, *S. González* 999 (ENCB); Sierra de Las Cruces, 13 Aug 1896, *C. G. Pringle* 7088 (MEXU); Llano de La Cieneguilla, cerca del Cerro de La Palma, Sierra de Las Cruces, 9 Jul 1967, *J. Rzedowski* 23873 (ENCB); Puerto de Las Cruces, Deleg. Cuajimalpa, 24 Jun 1973, *J. Rzedowski*

30808-a (ENCB), 20 Jul 1980, *J. Rzedowski* 36725 (ENCB).—HIDALGO: Cerro de Las Ventanas, al N de Pachuca, 14 Aug 1963, *J. Rzedowski* 17032-a (ENCB).—MÉXICO: Mpio. Ixtapaluca, 8 km S of Río Frío along main road from hwy to Estación Experimental Zoquiapan, 3100–3200 m, 8 Oct 1983, *W. R. Anderson et al.* 12949 (ENCB, MEXU, MICH); Mpio. de Chalco, Llano de Aculco, 10 km al SW de Río Frío, 15 Aug 1972, *J. Rzedowski* 29130 (ENCB); Villa Alpina, Naucalpan, 2 Jul 1978, *J. Rzedowski* 35695 (ENCB), 1 Jul 1979, *J. Rzedowski* 36154 (ENCB); Mpio. de Iturbide, cerca de la Presa Iturbide, 8 Jun 1980, *J. Rzedowski* 36675 (ENCB); Mpio. de Tlalmanalco, La Ciénega, región de la cabeza del Ixtaccíhuatl, 18 Jul 1982, *J. Rzedowski* 37861 (ENCB); 3.2 road km N of Paso de Cortés, S slope of Volcán Ixtaccíhuatl, 12,500 ft, 21 Aug 2000, *P. F. Zika* 15389 (MICH).—MICHOACÁN: Mpio. de Zinapécuaro, base del Cerro del Gallo, cerca del yacimiento de caolín, 13 Jul 1989, *M. J. Jasso* 1116 (IEB); Mpio. Santa Clara del Cobre, La Laguna, cerca de San Gregorio, 2700 m, 7 Jul 1985, *J. Rzedowski* 38747 (IEB); Mpio. de Santa Clara del Cobre, La Lagunita, cerca de San Gregorio, 2700 m, 21 Jul 1987, *J. Rzedowski* 43817 (CIIDIR, ENCB, IEB).—OAXACA: Mpio. Comaltepec, near Cerro Pelón, along Hwy 175 (Tuxtepec-Oaxaca Hwy), 17°34'23"N, 96°30'20"W, 2930 m, 16 Jul 1997, *S. González & A. A. Reznicek* 10532 (CIIDIR, IEB, MICH).—PUEBLA: Iztaccíhuatl, south side of mtn, 3940 m, 31 Jul 1958, *J. H. Beaman* 1979 (GH).

Carex boliviensis* subsp. *occidentalis Reznicek & S. González, subsp. nov.—TYPE: MEXICO. Durango: Mpio. Durango, aprox. 61 km al S de Durango, por el camino a La Flor, 2670 m, 13 Jul 1990, *S. González* 4461 con *A. García y S. Acevedo* (holotype: CIIDIR!; isotypes: IEB! MEXU! MICH!).

Habitu *Carici boliviensi* subsp. *boliviensi* similis, inflorescentiis, spicis terminalibus, basibus staminatis spicarum terminalium longioribus differt.

Culms 35–87 cm tall, somewhat wiry and flexuous or not, erect, arching or ± decumbent, 0.2–0.65 (–0.85) mm wide at ca. 1 cm below the inflorescence, prominently scabrous- or ciliate-angled; bladeless basal sheaths brown to red or dark purple. Inflorescences (1–) 2.5–6.1 mm long, the lowest bracts often foliaceous, 1–8.5 cm long, shorter or often longer than the inflorescence; terminal spikes (9–) 15–30 mm long, the staminate portion 3–22 mm long, often more than half the length of the spike. Pistillate scales 1.8–3.4 mm long; staminate scales 3–4.8 mm long. Perigynia 3–4.1 (–4.6) mm long. Achenes 2–2.6 mm long. Anthers 1.7–2.3 mm long.

Carex boliviensis var. *occidentalis* is common, sometimes abundant, in marshy areas in openings in pine or pine-oak forest of the Sierra Madre Occidental in Chihuahua, Durango, Jalisco, and Guerrero from (2000–) 2500–3200 m (Fig. 3).

This subspecies seems to be most frequent in Durango, where it is a very prevalent component of marshy montane meadows, often forming extensive colonies. A collection from southern Durango (*S. González* 2368) is especially robust, with erect culms 0.6–0.85 mm wide.

REPRESENTATIVE SPECIMENS. **Mexico.** CHIHUAHUA: Mpio. Bocoyna, ca. 2–3 mi N of San Juanito road to El Alamito-San Pedro, 2300 m, 2 Aug 1977, *R. Bye & W.A. Weber* 7844 (SD).—DURANGO: Mpio. Pueblo Nuevo, 7 km W de El Salto, 21 Aug 1981, *S. González* 1911 (CIIDIR; duplicates to be distributed); Mpio. El Mezquital, 22 km al NE de Los Charcos, 1 Nov 1982, *S. González* 2368 (CIIDIR; duplicates to be distributed); Mpio. Durango, entrada al predio Las Bayas (UJED), 93 km al S de Durango, 2700 m, 13 Jul 1990, *S. González* 4491 (CIIDIR, MICH); Mpio. Durango, Cerro La Gruya, predio Las Bayas, al S de Durango, 15 Jul 1990, *S. González* 4543 (CIIDIR); aprox. 10 km de Los Charcos, por el camino a Santa María Ocotán, 2630 m, 18 Jun 1992, *S. González* 5155 (CIIDIR, IEB, MEXU, MICH); Mpio. El Mezquital, aprox. 16 km de La Ventana, camino Los Charcos–Santa María Ocotán, 18 Jun 1992, *S. González* 5163 (CIIDIR, MICH); 1 km al S de Buenos Aires, cerca de la carretera Durango–Mazatlán, en sitio inundable, 23°42'15"N, 105°43'26"W, 19 Aug 1999, *S. González* 6179 (CIIDIR, ENCB, IEB, MEXU, MICH); Mpio. Pueblo Nuevo, Km 134 carretera Durango–Mazatlán, 3 Nov 1990, *S. González & M. González* 4880 (CIIDIR); El Salto, Aserraderos, Sierra Madre Occidental, 2530–2540 m, 28 Aug 1934, *F. W. Pennell* 18368 (MEXU, PH, US); Mpio. El Salto, Sierra Madre Occidental, 3.2 mi E of La Cuidad along Hwy 40 (near 23°44'N, 105°40'W), 2600 m, 19 Aug

1988, *A. C. Sanders 8135* (VDB).—GUERRERO: Distr. Mina, Teotepec, 3200 m 17 Jul 1939, *G. B. Hinton 14460* (ENCB, LL, MICH, NY).—JALISCO: Mpio. Autlán, camino en el file de la vaca, por el límite W de la propiedad, Las Joyas, Autlán, 19°35'37"N, 104°16'38"W, 2040 m, 28 Jul 1985, *A. Vásquez 3452* (ZEA).

CAREX COMPLANATA

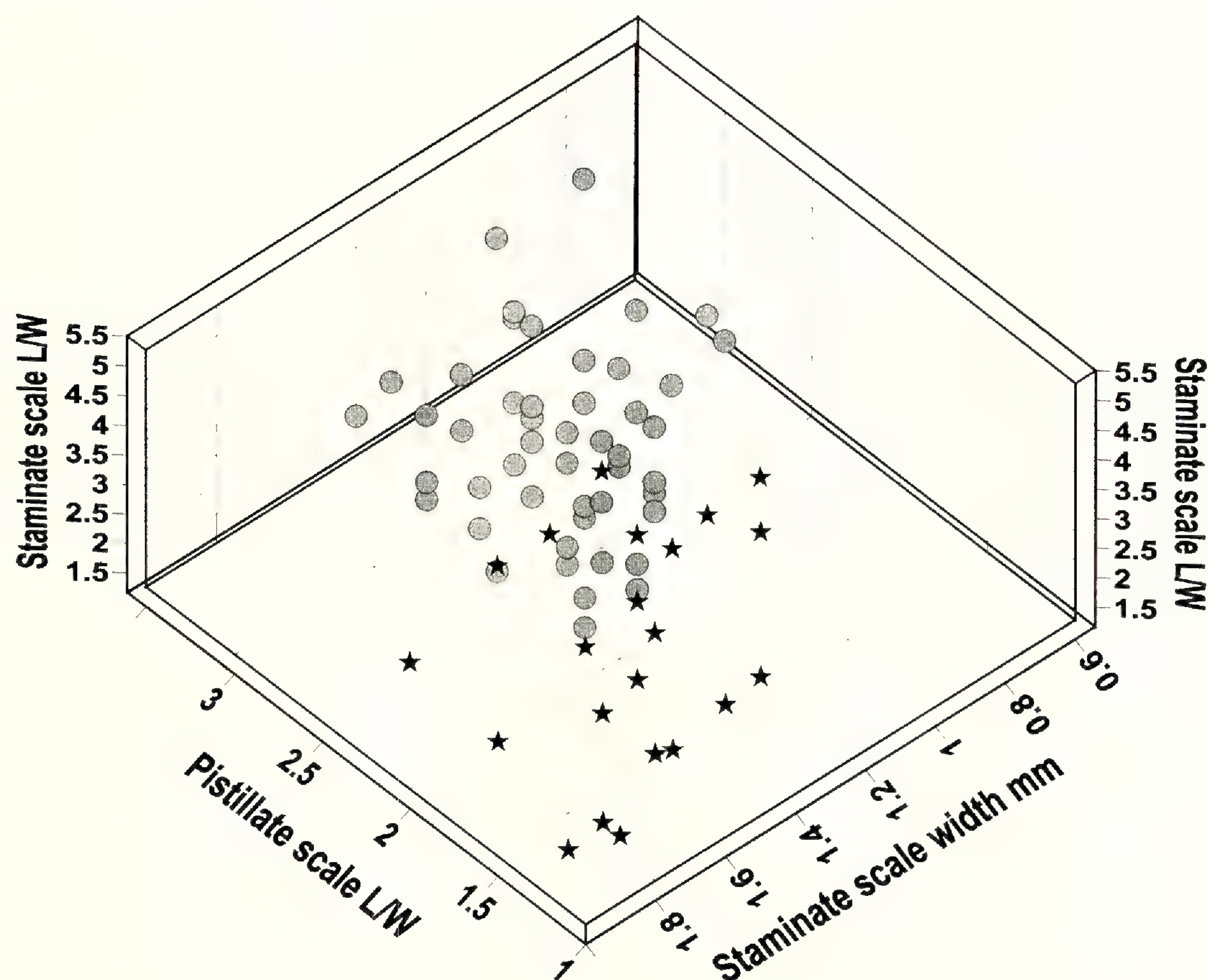
Carex complanata, as it occurs in Chiapas and Guatemala, differs from material from the southeastern United States in a few subtle features. Though the ranges are fairly similar, there is a strong tendency for the awns of the pistillate scales, especially of those in the middle portions of the spikes, to be shorter, giving the spikes a somewhat less "bristly" appearance as compared with plants from the southeastern United States. Tropical plants have awns 0.1–0.5 (–0.8) mm long, and plants from the southeastern United States have awns mostly 0.3–0.9 mm long. Also, both the pistillate and staminate scales have a strong tendency to be broader in the tropical plants. Scales from the middle of the pistillate portion of the spikes are 1.6–2.5 times as long as wide in the tropical plants and (1.9–) 2.3–3.3 times as long as wide in temperate plants. Scales from the middle of the staminate portion of the terminal spikes are (1–) 1.2–1.6 (–1.8) mm wide and 1.8–2.9 (–3.1) times as long as wide in the tropical plants versus 0.9–1.5 mm wide and (2.2–) 2.7–5 times as long as wide in temperate plants. These features are both subtle and show some degree of overlap (Fig. 2), but taken in combination allow almost all plants to be recognized without recourse to geography. Although only subtly different, the distinctions nevertheless suggest that the occurrence of *C. complanata* in southern Mexico and Guatemala is not the result of a very recent introduction. We describe the tropical entity as a geographically isolated subspecies, *C. complanata* subsp. *tropicalis*.

A relative of *C. complanata* in North America, *C. hirsutella*, is also sometimes recognized at infraspecific rank as *C. complanata* var. *hirsuta* (Gleason & Cronquist 1991). It differs consistently in its much more pubescent foliage and is here viewed as a separate species. Some authors, e.g., Correll and Johnston (1970), have suggested that *C. complanata* should also include *C. bushii* and *C. caroliniana*, but this view has not gained acceptance, and we recognize *C. complanata* in the restricted sense of Mackenzie (1935).

Carex complanata* subsp. *tropicalis Reznicek & S. González, subsp. nov.—
TYPE: MEXICO. Chiapas: Mpio. Larrainzar, along road between San Andrés Larrainzar and Puerto Cato, 16°55'04"N, 92°45'34"W, 12 Jul 1997, *S. González & Reznicek 10515*, *M. González*, *M. Pinedo* (holotype MICH!; isotypes: CHDIR!, others to be distributed).

Habitu Carici complanatae subsp. complanatae similis, squamis pistillatis staminatis latioribus, aristis brevioribus differt.

Densely caespitose from hard rhizomes rarely more than 0.5 cm long between shoots, forming small to large clumps; fertile culms (20–) 35–86 cm long, stiff, erect to spreading, trigonous, 0.45–1.1 mm wide ca. 1 cm below the inflorescence, the angles acute, prominent, smooth or minutely scabrous; bladeless basal sheaths dark purple or purple-tinged, becoming ruptured and somewhat fibrillous. Leaves 5–10, on the lower 1/4 of the culms; blades 15–38 cm long, 1.5–3.5 (–4) mm wide, flat, rarely conduplicate, nearly glabrous or scabrous to short-pilose distally and at



● *Carex complanata* subsp. *complanata* ★ *Carex complanata* subsp. *tropicalis*

FIG. 2. *Carex complanata*. Staminate scale width (mm) versus pistillate scale l/w versus staminate scale l/w

the lower parts; leaf sheaths 2.5–16 cm long, tight, pale-green, dorsally glabrous or very sparsely short-pilose, the inner band whitish or pale-brown, short-pilose to hirsute, paler, sometimes red-dotted, membranous, hyaline and easily ruptured, the apex truncate to concave, ciliate; ligules shorter than wide, 0.5–1.4 mm long, the free portion 0.3–0.5 mm wide, ciliate, whitish to brownish or reddish. Inflorescences 1–2.9 cm long, spikes 2–5, overlapping, single at nodes, sessile or nearly so; bracts the lowest bracts 0.8–8.8 cm long, 0.4–2.2 mm wide, usually exceeding the terminal spike, sheathless or with a sheath up to 2.5 mm long, the upper bracts much reduced, setiform; terminal spike gynaeandrous with an ovoid to ovoid-cylindrical pistillate portion 5–13 mm long and (4.4–) 4.8–7.3 mm broad, the staminate portion 3–7 mm long, short-obconic; lateral spikes pistillate, ovoid to cylindrical, 4–14 mm long, 4.3–6 mm wide, sessile or very short-peduncled, with 7 to 70 perigynia. Pistillate scales (1.4–) 1.6–2.8 (–3.3) mm long, 1–1.5 mm wide, 1.3–2.5 times as long as wide, ovate, narrower and shorter than or more or less equaling the perigynia, obtuse to acuminate, often short-awned or minutely cuspidate, the longest awns 0.1–0.5 (–0.8) mm long, the lower more strongly acuminate than the upper, glabrous, stramineous hyaline to brownish hyaline with a green, stramineous or pale brown 3-nerved center, the center smooth or sparsely and minutely scabrous; staminate scales 2.3–4 (–4.6) mm long, 1–1.8 (–2) mm wide, 1.8–3.1 times as long as wide, ovate, acute to acuminate, stramineous to brownish hyaline

with a green, stramineous, or pale brown 3–5-nerved center. Perigynia 2–2.8 mm long, 1.2–1.9 mm wide, widest at 1–1.5 mm below apex, ascending, triangular to flattened-triangular or unequally biconvex, obovoid, glabrous (rarely minutely scabrous on the angles), firm-membranous, not inflated, olive-brown to brown, 2-ribbed, with several weak nerves that are inconspicuous at full maturity, the perigynia tapering to the base and to the apex, beakless, with a nearly entire, inconspicuous orifice. Achenes 1.7–2.2 mm long, 1.2–1.5 mm wide, trigonous, obovoid to ovoid, yellowish to brown, puncticulate, sessile to short-pedicellate, bent-apiculate. Style withering; stigmas 3. Anthers 3, 1.5–1.9 mm long.

Carex complanata subsp. *tropicalis* is found in Chiapas and Guatemala (Fig. 3) in moist, shrubby openings and on steep slopes of mesophytic pine-oak forests from 1600 to 2800 m. Flowering and fruiting occur all year long. Subspecies *tropicalis* appears to be a plant of successional openings. It forms robust, spreading clumps with many culms in recent clearings and other disturbed open areas. In denser or shadier sites, it occurs as smaller clumps with few, lax culms, sometimes erect or leaning on other vegetation.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** CHIAPAS: 2 km N of Jitotol on road to Pichucalco, 1620 m, 20 Oct 1983 *W. R. Anderson et al.* 13243 (MICH); Mpio. Tenajapa, near crest of ridge in the paraje of Banabil, 9100 ft, 10 Oct 1965, *D. E. Breedlove* 12943 (MICH); Mpio. La Independencia, 6–10 km NNE of La Soledad along logging road from Las Margaritas to Campo Alegre, 1600 m, 30 Sept 1981, *D. E. Breedlove* 53191 (ENCB); Mpio. Jitotol, 10 km N of Jitotol near Río Hondo, 8 Nov 1981, *D. E. Breedlove* 55135 (ENCB, NY); Mpio. Jitotol, near Colonia El Laurel, ca. 5 km N of Jitotol, 1600 m, 13 Nov 1984, *G. Davidse et al.* 29623 (MICH, MO); Mpio. Tenejapa, ca. 1 km S of Tenejapa (Km 26.7) along road to San Cristóbal de Las Casas, 16°49'03"N, 92°30'08"W, 10 Jul 1997, *S. González & Reznicek* 10469 (CAS, CIIDIR, IEB, MICH, MO); Mpio. Tenejapa, near Colonia Ach'lum, 16°46'50"N, 92°26'55"W, 11 Jul 1997, *S. González & Reznicek* 10493 (CIIDIR, MICH); 10 km SE of Jitotol on road to Bochil, 5600 ft, 25 Jan 1965, *P. H. Raven* 20059 (MICH); Mpio. Pueblo Nuevo Solistahuacán, Clínica Yerba Buena, 2 km NW of Pueblo Nuevo Solistahuacán, 5400 ft, 23–24 Jan 1965, *P. H. Raven* 19879 & *D. E. Breedlove* (MICH); Mpio. Tenajapa, at the Paraje Matsab, 9000 ft, 12 May 1966, *A. S. Ton* 943 (F, MICH, MO). **Guatemala.** ALTA VERAPAZ: Sierra de las Minas, 3 km SE of Purulh, 2000 m, 6 Jan 1974, *L. O. Williams et al.* 43413 (BM, F, MICH).

CAREX ANGUSTISPICA

Several recent collections from subalpine habitats in Oaxaca of plants somewhat similar to *C. complanata* consistently differ in a number of features from both *C. complanata* in Chiapas and Guatemala, and representatives from the United States. These Oaxacan collections have very broad pistillate scales, only 1.2–1.6 times as long as wide, which are merely obtuse to acute and lack an awn, having at most a tiny cusp, contrasted with scales 1.6–3.3 times as long as wide with awns 0.1–0.9 mm long in *C. complanata*. Also, achenes are shorter, only 1.4–1.8 mm long, contrasted with achenes 1.7–2.2 mm long in *C. complanata*. The spikes in the subalpine plant are also narrower, with the terminal spikes 2.8–5.1 mm wide versus terminal spikes (4.4–) 4.8–7.3 mm wide in *C. complanata*. The several differences involving inflorescences, scales, and achenes, as well as the distinctive subalpine habitat of this taxon, argue for its recognition at specific rank.

Carex angustispica Reznicek & S. González, sp. nov.—TYPE: MEXICO. Oaxaca: Sierra de Juárez, along Hwy 175, 1.5 km by road SW of mirador at Cerro Pelón, 21 Feb 1988, *A. A. Reznicek & S. A. Reznicek* 8093 (holotype: MICH!; isotypes: ENCB! GENT! MEXU!).

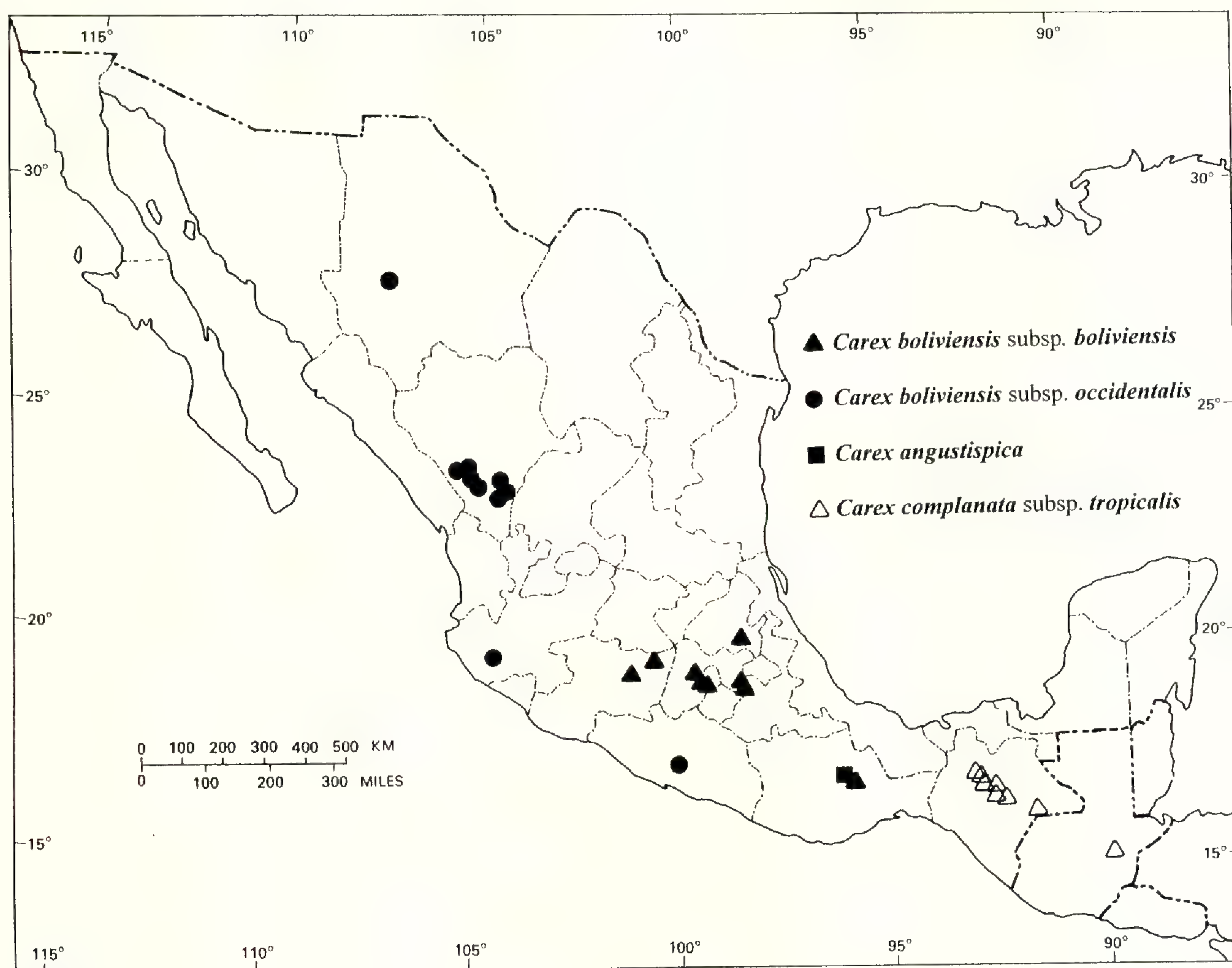


FIG. 3. Distribution of *Carex* sect. *Porocystis* in Mexico and Central America.

Dense cespitosae; culmi (3–) 10–65 cm alti; vaginae basales purpurascentes. Folia 5–10, plerumque basalia; laminae (2.5–) 5–28 cm longae, 1.2–3.6 mm latae; vaginae 0.8–4.5 cm longae, glabrae, ventraliter brevipilosae; ligulae 0.2–1.6 mm longae. Inflorescentiae 0.8–4.5 cm longae; spicae 2–4 (–5), plus minusve erectae; spica terminalis gynaeandra, spicae laterales pistillatae; bracteae infimae laminis 0.5–6 cm longis, 0.4–2.6 mm latis, plerumque evaginatiss. Perigynia 2.1–2.8 mm longa, 1.2–1.5 mm lata, ovoidea vel obovoidea, complanato-trigona, ascendencia, viridia vel brunnea, erostrata. Achenium 1.4–1.8 mm longum, 1.1–1.3 mm latum. Styli marcescentes; stigmata 3. Antherae 3, ca. 1.3–1.7 mm longae.

Densely cespitose from hard rhizomes rarely more than 0.5 cm long between shoots, usually scattered in small clumps; fertile culms (3–) 10–65 cm long, erect, stiff, trigonous, 0.4–1.2 mm wide ca. 1 cm below the inflorescence, the angles acute, smooth to minutely scabrous; bladeless basal sheaths reddish purple-tinged, spikes pistillate, ovoid to cylindrical, 4–14.5 mm long, 3–4.8 mm wide, with ca. 5–40 perigynia. Pistillate scales 1.6–2.4 (–2.6) mm long, 1.3–1.7 mm wide, ca. 1.2–1.6 times as long as wide, ovate to broadly ovate, wider and shorter than the perigynia, obtuse to acute, sometimes minutely cuspidate, glabrous, stramineous hyaline to brownish with a green or pale brown 3-nerved center and narrow hyaline margins, the center smooth or sparsely and minutely scabrous; staminate scales 2.8–3.3 mm long, 1.3–1.9 mm wide, ca. 1.7–2.2 times as long as wide, ovate, acute to acuminate, stramineous to brownish with a green or pale brown 3–5-nerved center and narrow hyaline margins. Perigynia 2.1–2.8 mm long, 1.2–1.5 mm wide, widest at 1.1–1.4 mm below apex, ascending, flattened-trigonous, ovoid to obovoid,

glabrous, firm-membranous, not inflated, green to brown, 2-ribbed with ca. 9–14 weak nerves that are inconspicuous at full maturity, the perigynia tapering to the base and to the apex, beakless, with a nearly entire, inconspicuous orifice. Achenes 1.4–1.8 mm long, 1.1–1.3 mm wide, flattened-trigonous, obovoid, yellowish to brown, punctulate, sessile to short-pedicellate, bent-apiculate. Style withering; stigmas 3. Anthers 3, ca. 1.3–1.7 mm long.

Carex angustispica occurs in Oaxaca in grassy and sedgy areas among ericaceous shrubs in subalpine habitats or open pine forest on mountain summits and upper slopes at ca. 2800–3000 m. It fruits from late August to February.

This species is smaller in stature than *C. complanata* and sometimes forms a dwarf “turf” in gravelly, sterile openings. The culms tend to be stiffly erect, not spreading to ascending, like those of *C. complanata* subsp. *tropicalis*. *Carex angustispica* presumably grows on acidic soils; it is found on volcanic rock in association with various members of the Ericaceae. *Carex complanata* subsp. *tropicalis* occurs often in areas of limestone soils. Also, it flowers and fruits throughout the year, but *C. angustispica* has been collected in fruit only from August through February.

The vicinity of Cerro Pelón, Oaxaca, is the only area of Mexico where more than one species of sect. *Porocystis* occurs. In addition to *C. angustispica*, *C. boliviensis* subsp. *boliviensis* has been collected there (Fig. 3).

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** OAXACA: 47 km al N de Ixtlán de Juárez, sobre la carretera a Tuxtepec (cerca de Cerro Pelón) [en lugares perturbados, cerca de matorral de Ericáceas], S. González 1014 (ENCB, IEB, MEXU); Cerro del Humo, 9300 ft, 10 Aug 1975, R. O. Lawton 803 (F, MO); along Mex Hwy 175, 30.5 mi NE of Guelatao, 24 Dec 1975, A. A. Reznicek & D. R. Gregory M-319 (MICH); Sierra de Juárez, along Hwy 175, 0.6 km by road SW of mirador at Cerro Pelón, 21 Feb 1988, A. A. Reznicek & S. A. Reznicek 8077 (IEB, MICH), 8080 (CAS, MICH).

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A PURPLE COLOR FORM OF PITCHER'S THISTLE

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ABSTRACT. *Cirsium pitcheri* (Compositae), a thistle endemic to the sandy shores and dunes of lakes Michigan, Huron, and Superior, has hitherto been known to have heads only pale (white or cream) in color. A new form discovered at the north end of Lake Michigan has rich magenta corollas of a shade like that of the usual form of *C. vulgare*. This phenomenon is the reverse of the more usual discovery of a pale (or albino) form of a normally colored species.

Pitcher's Thistle, *Cirsium pitcheri* (Eaton) Torr. & A. Gray (Compositae), was originally found "by Dr. Zina Pitcher, on the great sand banks of Lake Superior" (Eaton 1829, p. 180). Amos Eaton admitted, however, that his specimen (and hence the type, apparently no longer extant) "was collected by Dr. E. James, at Lake Huron". Besides the Grand Sable dunes, which remain the only known site on the south shore of Lake Superior, the species occurs at one place on the north shore, and on various dunes and beaches along lakes Huron and Michigan. As a species endemic to the Great Lakes shores, it has been officially listed as threatened under Michigan law since 1980 and federal law since 1988.

Eaton said nothing of flower color, although Torrey and Gray (1843, p. 456) said "flowers ochroleucous." And indeed, subsequent authors have invariably declared the flowers to be white, cream-colored, yellowish white, or similarly pale—as in its nearest relative, *C. canescens* Nutt. (see Loveless & Hamrick 1988). I find no published mention of any other color form [other than a brief last-minute addition in *Michigan Flora Part III* (Voss 1996)]. Imagine our surprise, therefore, when C. Eric Hellquist and I came upon plants with deep magenta heads growing (along a federal highway!) with others of normal pale color—a reversal of the usual minor discovery of a white-flowered form in an ordinarily colored species. The heads in this population are as deep and rich red-purple as is normal in *C. vulgare* (Savi) Ten. and *C. muticum* Michx. Otherwise, the plants seem identical to typical *C. pitcheri*: e.g., large achenes (ca. 7 mm), corolla tubes shorter than in *C. vulgare*, spines absent on margins or surfaces of leaves—except a short one at the apex of each slender leaf lobe; and leaves (especially beneath), stems, and peduncles with the typical white tomentum of normal plants.

We discovered this population in 1995 southeast of the Brevort River in Mackinac County, Michigan, at the north end of Lake Michigan (or west end of the Straits of Mackinac, presumably within 15 miles or so from the type locality of the species; see Voss 1956, p. 24). There were three large bushy plants here, at a spot frequently trampled by tourists heading for the extensive beach. Tabulating the number of individuals is difficult, for some plants may have finished flowering or be too young at the time of counting (the species is perennial but monocarpic), and it is of course impossible to determine the flower color of the numerous seedlings and young individuals in the vicinity. However, in 1996 three purple-headed plants were again noted; in 1997 there were 7; in 1998, 17; and in 1999, 44. Always there were at least as many cream-headed plants plus many young individuals, and

occasional intermediate pink-headed ones. Then in 2000 there was a crash. I could find only 5 purple-headed individuals (plus some cream and immature ones). The cause was presumably extensive grading along U.S. Highway 2, scraping the dunes, and decimating this protected species and its as yet undescribed color form at this site. With luck, it will rebound; dunes, after all, are naturally disturbed (though not by heavy equipment). Some disturbance is in fact required for maintenance of this species (Hamzé & Jolls 2000).

In the meantime, it seems well to provide a name for this striking form of an endemic species:

Cirsium pitcheri forma **magenteum** E. G. Voss, f. nov.—TYPE: MICHIGAN. Mackinac Co.: disturbed area in low sand dunes along Lake Michigan, sec. 16, T41N, R5W, ca. 0.6 mi SE of Brevort River, 18 July 1995. *E. G. Voss 16509 with Eric Hellquist* (holotype: MICH!; isotypes: GH! MSC! UMBS!).

Cirsium pitcheri forma *magenteum* differt a forma typica corollis magenteis.

ADDITIONAL SPECIMENS EXAMINED (from the same locality): *Voss 16537 & Hellquist*, 16 July 1996 (MICH); *Voss 16730*, 11 July 2000 (MICH, WIS, NY, MIN).

Cirsium pitcheri is named for an eminent 19th century physician (see Voss 1978). Evidently Zina Pitcher discovered this thistle while stationed as an Army surgeon at Fort Brady, Sault Ste. Marie, 1826–1828. He later settled in Michigan and when the University was established in Ann Arbor the governor named him among its first regents. He served from 1837 until the post became elective in 1852. Always a scholar, Dr. Pitcher offered the motion to buy the first book for the University library—Audubon's *Birds of America* (at a bargain price of \$970). He was chairman of a regents committee that brought in a favorable report on establishing a medical department in the University. So he is often looked upon as the founder of the University of Michigan Medical School, on whose faculty he served from 1852 until his death in 1872. The street approaching the Medical Center from the south is now happily named Zina Pitcher Place, and a large oil portrait of him (on loan from the Medical School) hangs in the library of the University of Michigan Herbarium. He was an avid botanist, accumulating a large herbarium, and other plants have been named for him. I have always admired his thistle, even without knowing of this exceptional color form (my personal bookplate, designed in 1952, features a sketch of it).

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CORRECT ATTRIBUTION OF THE NAME SCEPTRIDIUM SUBBIFOLIATUM (OPHIOGLOSSACEAE)

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ABSTRACT. The correct name for the species described as *Botrychium subbifoliatum* Brack. (Ophioglossaceae) when assigned to the genus *Sceptridium* Lyon is *Sceptridium subbifoliatum* (Brack.) Lyon.

In a recent article on Hawaiian pteridophytes (Wagner et al. 1999), Wagner and Wagner proposed transferring *Botrychium subbifoliatum* Brack. (Ophioglossaceae) to the genus *Sceptridium* Lyon. They had overlooked that Lyon (1905) had already published the combination. The correct name for the species in *Sceptridium* is *Sceptridium subbifoliatum* (Brack.) Lyon.

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SYNOPSIS OF CROTON AND PHYLLANTHUS (EUPHORBIACEAE) IN WESTERN TROPICAL MEXICO

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ABSTRACT. Preliminary to a treatment of *Croton* and *Phyllanthus* in the *Flora Novo-Galiciana*, discussions of species, with citation of specimens and keys where appropriate, are presented for western Mexico. Forty-seven species of *Croton* and 21 species of *Phyllanthus* are recognized for the area. A new subsection *Xalapenses* of *Croton* sect. *Cyclostigma* is described. Two species of *Croton* are described as new: *C. mcvaughii* and *C. stenopetalus*. As a result of the revision of the species of *Croton* sect. *Velamea* in western Mexico, *Croton mazapensis* var. *pacificus* is described as new, and the new combination *C. morifolius* var. *brandegeanus* is applied to the taxon generally referred to as *C. flavescens*. *Phyllanthus* sect. *Brachycladus* is described as new; its only local representative is *P. mickelii*. In *Phyllanthus* sect. *Paraphyllanthus*, five species are recognized from western Mexico, and *P. peninsularis* subsp. *novogalicianus* is described as new.

INTRODUCTION

During studies on the Euphorbiaceae for the *Flora Novo-Galiciana* (FNG) in collaboration with Dr. Rogers McVaugh, it has become evident that a considerable number of taxonomic and nomenclatural changes in *Croton* and *Phyllanthus*, including descriptions of new taxa, are needed. Discussion of taxonomic problems sometimes extends outside the boundaries of FNG, hence for this study the region delineated in the map by McVaugh (1993) has been expanded to include tropical western Mexico (south of 28°N), including all or portions of the states of Baja California Sur, Sonora, Sinaloa, Chihuahua (west of 107°W), Nayarit (including Islas Tres Marías), southwestern Durango and Zacatecas, Aguascalientes, Jalisco, Colima, and Michoacán. Representative specimens (at least one locality per state) are cited for each species recorded from this area; complete specimen citations will appear for species included in FNG (additional citations are sometimes given for species outside Nueva Galicia). Circumscriptions of the sections of *Croton* follow Webster (1993), although some modifications have been found necessary.

CROTON

Within western tropical Mexico, *Croton* is represented by 47 species including 12 varieties. These are referable to 15 sections as delimited by Webster (1993), although study of the FNG species has indicated that circumscription and composition of some sections must be modified; revised descriptions of sections (as represented in the neotropics) are given where needed.

Since the study of the Euphorbiaceae of Nueva Galicia by McVaugh (1961), the species of *Croton* in western Mexico have been reviewed by Wiggins for the Sonoran Desert (1964) and Baja California (1980); more recently Steinmann and Felger (1997) have treated the species in Sonora. Martínez Gordillo (1995) has described and illustrated the species of Guerrero, many of which also occur in FNG.

KEY TO THE SECTIONS OF CROTON IN WESTERN MEXICO

1. Petals well developed in both ♂ and ♀ flowers; indumentum lepidote. 3. *Croton* sect. *Eluteria*.
1. Petals absent or greatly reduced in ♂ flowers; indumentum stellate or dendritic (rarely stellate-lepidote).
 2. Lower nodes of inflorescence with both ♂ and ♀ flowers; petiolar glands conspicuous; indumentum at least in part of dendritic hairs.
 3. Styles multifid; sepals of ♀ flowers glabrous adaxially. 1. *Croton* sect. *Cleodora*.
 3. Styles bifid; sepals of ♀ flowers stellate-pubescent adaxially.
 2. *Croton* sect. *Cyclostigma* (subsect. *Cyclostigma*).
 2. Lower nodes of bisexual inflorescences with ♀ flowers only (if ♂ flowers present, then petiolar glands obsolete).
 4. Petals absent in both ♀ and ♂ flowers; indumentum stellate-lepidote.
 15. *Croton* sect. *Drepadenium*.
 4. Petals present in ♂ flowers; indumentum usually stellate.
 5. Leaf blades deeply 3-lobed; receptacle (disk) of ♂ flower glabrous; seeds tetragonal.
 14. *Croton* sect. *Astraea*.
 5. Leaf blades not deeply lobed; receptacle (disk) of ♂ flower usually copiously villose; seeds more or less ellipsoidal and compressed.
 6. Styles multifid; leaf blades without paired glands at base.
 7. Indumentum of leaves lepidote; sepals of ♀ flowers reduplicate-valvate.
 13. *Croton* sect. *Argyroglossum*.
 7. Indumentum of leaves stellate (stellate-lepidote in *C. michaelii*); sepals of ♀ flowers not reduplicate.
 8. Stipules well developed, >1 mm long.
 9. Stipules entire, not glandular; leaf blades pinnately veined, without stalked glands. 5. *Croton* sect. *Anadenocroton*.
 9. Stipules glandular-dissected; leaf blades triplinerved or palmately veined, with few to many stalked capitate glands. 11. *Croton* sect. *Adenophyllum*.
 8. Stipules rudimentary, <1 mm long. 12. *Croton* sect. *Medea*.
 6. Styles bifid; leaf blades with or without paired glands at base.
 10. Leaf blades with paired glands at base of leaf or apex of petiole.
 11. Sepals of ♀ flower markedly unequal; bracts with basal clusters of glands; stamens 8–10. 8. *Croton* sect. *Geiseleria*.
 11. Sepals of ♀ flower subequal; bracts without basal clusters of glands; stamens 8–40.
 12. Leaf blades coarsely double-dentate, 2–10 cm long; stamens 8–12.
 4. *Croton* sect. *Corylocroton*.
 12. Leaf blades entire to serrulate.
 13. Leaf blades acuminate, rounded or cordate at base, 7–20 cm long, petioles 1–5 cm long; stamens 22–35.
 2. *Croton* sect. *Cyclostigma* (subsect. *Xalapenses*).
 13. Leaf blades obtuse or acute, obtuse or cuneate at base, 3–6 cm long, petioles 0.5–1 cm long; stamen number unknown.
 6. *Croton* sect. *Cascarilla*.
 10. Leaf blades eglandular at base (or glands not over 0.2 mm in diameter).
 14. Fruiting pedicels 3–7 mm long, recurving; herbs; leaf blades entire.
 9. *Croton* sect. *Gynamblosis*.
 14. Fruiting pedicels less than 3 mm long, not recurving; herbs, shrubs, or trees; leaf blades entire or dentate.
 15. Sepals of ♀ flower markedly unequal, margin laciniate.
 10. *Croton* sect. *Julocroton*.
 15. Sepals of ♀ flower equal or subequal, margin entire.
 16. Stipules entire, not glandular; leaves stellate-pubescent, ovate to lanceolate. 7. *Croton* sect. *Velamea*.
 16. Stipules glandular-dissected or leaves stellate-lepidote, linear.
 12. *Croton* sect. *Medea*.

- 1. Croton** section **Cleodora** (Klotzsch) Baillon, *Étude Euphorb.* 369. 1858.—LECTO-TYPE, designated by Webster, 1993: *Cleodora sellowiana* Klotzsch [= *C. sphaerogynus* Baillon].

Our representative of this section, *Croton billbergianus* Müll. Arg., is the single Mexican representative of this otherwise mainly South American group. Although this species was placed only tentatively within sect. *Cleodora* (Webster 1993), further review indicates that this is indeed where it belongs.

- 1.1. Croton billbergianus** subsp. **pyramidalis** (Donn. Sm.) G. L. Webster, *Ann. Missouri Bot. Gard.* 75: 1123. 1988. *Croton pyramidalis* Donn. Sm., *Bot. Gaz.* 35: 7. 1903.—TYPE: GUATEMALA. Alta Verapaz: Río Dolores near Cubilgüitz, *Türckheim* 7974 (holotype: US!).

The two collections from a limited area in oak and pine woodlands (>1000 m) in the Sierra de Manantlán are the first records of this subspecies west of Oaxaca; it is not reported from Guerrero by Martínez Gordillo (1995).

SPECIMENS EXAMINED. JALISCO: Mpio. Cuautitlán, 1–2 km SW of Telcruz, *Vázquez & Zúñiga* 4487 (IBUG, WIS); 2 km SE of Las Marías, *Santana et al.* 5307 (IBUG, WIS).

- 2. Croton** section **Cyclostigma** Griseb., *Fl. Brit. W. Ind.* 42. 1859.—TYPE: *Croton gossypiifolius* Vahl.

This large section of about 50 mainly neotropical species is poorly represented in FNG; the only typical species is *Croton draco* Schltdl. & Cham., in subsect. *Cyclostigma* (Griseb.) Müll. Arg. However, there are three aberrant species that lack bisexual lower cymules in the inflorescences but resemble species of sect. *Cyclostigma* in habit: *C. suberosus* Kunth in H. B. K., *C. xalapensis* Kunth in H. B. K., and *C. stenopetalus*; the last is here diagnosed as new. In order to accommodate these three species in sect. *Cyclostigma*, it seems best to create a new subsection for them; this now gives a total of four subsections, as indicated in the key.

KEY TO THE SUBSECTIONS OF CROTON SECTION CYCLOSTIGMA

1. Pistillate flowers distinctly pedicellate; leaves with petiolar glands; lower cymules of bisexual thyrses with ♂ flowers; stamens 10–150.
2. Styles bifid; sepals of ♀ flowers not reduplicate-valvate; leaf blades palmately or pinnately veined, copiously stellate-pubescent or sparsely pubescent; stamens 15–65.
3. Leaf blades palmately or pinnately veined, copiously stellate-pubescent; stamens 15–65.
Croton subsect. *Cyclostigma*.
3. Leaf blades pinnately veined, sparsely pubescent; stamens 15–20.
Croton subsect. *Sampatik*.
2. Styles multifid; sepals of ♀ flowers more or less reduplicate-valvate; leaf blades mostly palmately veined, copiously stellate-pubescent; stamens 10–150. *Croton* subsect. *Palanostigma*.
1. Pistillate flowers sessile or subsessile; leaves with or without petiolar glands; lower cymules of bisexual thyrses lacking ♂ flowers; stamens 12–35. *Croton* subsect. *Xalapenses*.

- 2-1. Croton** subsection **Cyclostigma** (Griseb.) Müll. Arg., *Linnaea* 34: 81. 1865.—TYPE: *Croton gossypiifolius* Vahl.

2-1.1. *Croton draco* Schltdl. & Cham., *Linnaea* 6: 360. 1831.—TYPE: MEXICO. Veracruz: “in sylvaticis Papantlae,” *Schiede 1127* (holotype: HAL; isotype: W!).

This is the only species of subsect. *Cyclostigma* in Mexico. It is the northernmost of the “sangre de drago” species, which exude red latex and range from Sinaloa and Veracruz south to Panama. In western Mexico *C. draco* occurs in arroyos or oak/pine forests, mostly above 800 m.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Mazatlán, 16 mi by road N of Chupaderos, *Webster & Breckon 15544*, *Webster & Lynch 17049* (DAV); Villa Unión, 1964, *Dickson* (UC).—NAYARIT: Mpio. Compostela, 28 mi by road SW of Tepic, *Webster & Breckon 15773* (DAV).—JALISCO: Mpio. Autlán de Navarro, Puerto Los Mazos, 10 mi SW of Autlán, *McVaugh 19558*, 22275 (MICH), *Webster & Breckon 16031* (DAV).—COLIMA: Mpio. Comala, SW foothills of Nevado de Colima, *McVaugh 16117* (MICH).—MICOACÁN: Mpio. Coalcomán, Sierra Naranjillo, *Hinton 13930* (LAM).

2-2. *Croton* subsection *Xalapenses* G. L. Webster, subsect. nov.—TYPE: *Croton xalapensis* Kunth in H. B. K.

Subsectio *Xalapenses* ab aliis subsectiones *Cyclostigmatis* differt cymulis infimis thyrsi tantum ♀, floribus ♀ sessilibus vel subsessilibus, glandulis petiolorum interdum exiguis vel nullis.

Subsection *Xalapenses* includes both Mesoamerican and South American species, such as *Croton pungens* Jacq., *C. chilensis* Müll. Arg., and *C. boliviensis* Müll. Arg. The total number of species will not be certain until sect. *Cyclostigma* is revised.

KEY TO SPECIES OF CROTON SUBSECTION XALAPENSES IN WESTERN MEXICO

1. Climber; petals of ♂ flowers linear-lanceolate, 4–4.5 mm long; stamens 22–27; petiolar glands 0.2–0.5 mm in diameter. 2-2.2. *C. stenopetalus*.
1. Erect shrubs; petals of ♂ flowers ovate-lanceolate to spatulate, 2.5–3.5 mm long; stamens 12–55; petiolar glands absent or ca. 1 mm in diameter.
 2. Petiolar glands ca. 1 mm in diameter; seeds rugose-ribbed; stamens 22–35. 2-2.1. *C. xalapensis*.
 2. Petiolar glands absent; seeds smooth; stamens 12–15. 2-2.3. *C. suberosus*.

2-2.1. *Croton xalapensis* Kunth in H. B. K., *Nov. gen. sp. 2*: 85. 1817.—TYPE: MEXICO. Veracruz: Jalapa, *Humboldt & Bonpland* (holotype: P-HBK!).

The population in western Michoacán appears to be disjunct from those in eastern Mexico (Veracruz to Chiapas). *Croton xalapensis* is common in secondary forests from Mexico to Costa Rica, from near sea level to over 1000 m.

REPRESENTATIVE SPECIMENS. MICOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 15899* (MICH); Mpio. Jungapeo, San José Purúa, *Hinton 13806* (MO).

2-2.2. *Croton stenopetalus* G. L. Webster, sp. nov.—TYPE: MEXICO. Jalisco: Mpio. Tolimán, Sierra de Manantlán, 1–1.5 km W of El Terrero, *Santana & DeNiz 4543* (holotype: IBUG 9335!; isotype: WIS!). Fig. 1.

Arbuscula monoica scandens, foliis lanceolatis acuminatis triplinerviis, trichomata stellata plusminusve adpressa; glandulae laminae minutae; petioli glandulosi; inflorescentiae 5–6 cm longae, ad basin floribus ♀ 1–3; flos ♀ pedicello 5–7.5 mm longo; petala lineari-lanceolata, 4–4.5 mm longa, minus quam 1 mm lata; stamina 22–27, filamentis glabris; sepala integra, 2.5–3 mm longa; styli bifidi.

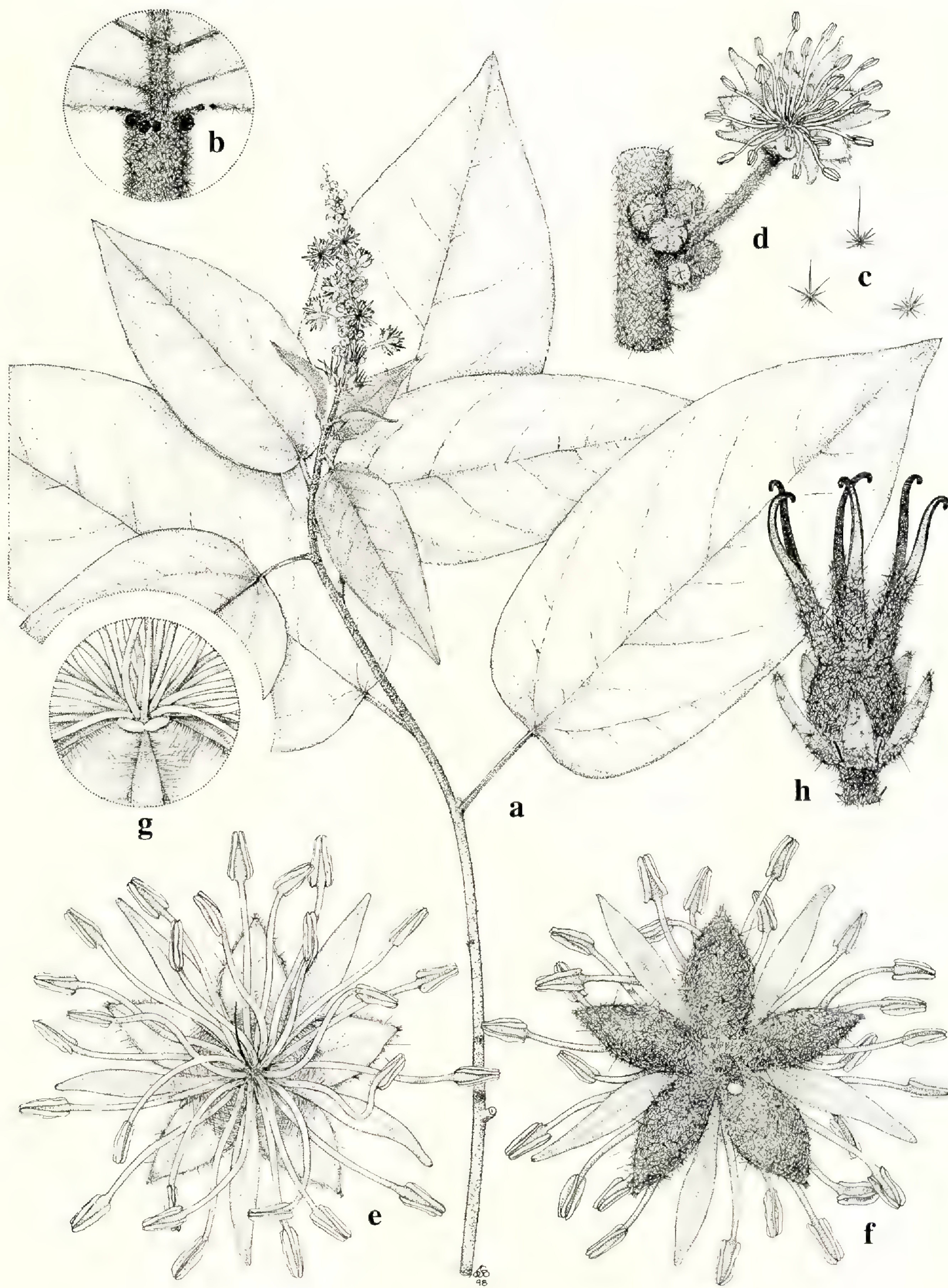


FIG. 1. *Croton stenopetalus*. A. Flowering branch, $\times 0.5$. B. Rudimentary glands at base of leaf blade, $\times 10$. C. Stellate-pore trichomes, $\times 10$. D. Staminate cymule with one open flower, $\times 2.5$. E. Staminate flower, view from above, $\times 6$. F. Staminate flower, view from below, $\times 6$. G. Basal parts of stamens and petals, $\times 10$. H. Pistillate flower, $\times 6$.

This rare species, known only from two collections in cloud forest at 2000–2200 m in the Sierra de Manantlán, is distinctive because of its scandent habit and the very narrow petals in the ♂ flower. It appears to be most similar to *C. xalapensis*, but in addition to its distinctive habit differs in its narrower and less densely pubescent leaf blades, which lack well-developed patelliform glands. Also, the ♂ flowers are borne on longer pedicels and have narrower petals.

ADDITIONAL SPECIMEN EXAMINED. JALISCO: Mpio. Tolimán, 3 km W of El Terrero, *Santana & Ceballos 4559* (IBUG).

2-2.3. *Croton suberosus* Kunth in H. B. K., Nov. gen. sp. 2: 86. 1817.—TYPE: MEXICO. Guerrero: Acapulco, *Humboldt & Bonpland 3862* (holotype: P-HBK!).

Croton cladotrichus Müll. Arg., Linnaea 34: 124. 1865.—TYPE: MEXICO. Unknown collector, “Herb. Pavón” (holotype: G!).

Croton purpusii Brandege, Univ. California Publ. Bot. 6: 184. 1915.—TYPE: MEXICO. Oaxaca: San Gerónimo, *Purpus 7146* (holotype: UC!).

In general, *C. suberosus* resembles other species of sect. *Cyclostigma* in its large cordate leaves, elongate stipules, and dendritic indumentum; however, it lacks petiolar glands and bisexual cymules in the inflorescence, and it has smooth (rather than ribbed) seeds. Its position therefore must be regarded as anomalous. It is curious that this species, which extends along the Pacific Coast lowlands (elev. 300–400 m or less) to Guerrero and Oaxaca, has not been collected in Nayarit.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Escuinapa de Hidalgo, forest along MEX-15 ca. 11 mi N of Nayarit border, *Clarke et al. 1547-5* (DAV); Mpio. Mazatlán, N of Mazatlán, *Mexia 55, 1097, Shreve 7813* (MO).—DURANGO: Mpio. Toyaltita, 54 km SW de San Miguel de Cruces, *Tenorio & Romero 6247* (DAV; identity doubtful).—JALISCO: Mpio. La Huerta, 15 km NE of Juan Gil Preciado, *Flores et al. 2767* (DAV).—COLIMA: 10 mi S of Colima, *Webster & Breckon 16102* (DAV).—MICHOACÁN: Mpio. Aquila, 4 km E of Río Motín del Oro, *Tucker 2953* (CAS).

3. *Croton* section *Eluteria* Griseb., Fl. Brit. W. Ind. 39. 1859. *Croton* subg. *Eluteria* (Griseb.) Pax & Hoffm., Nat. Pflanzenfam. 3(5): 38. 1890.—TYPE: *Croton eluteria* (L.) Sw. (based on *Cluytia eluteria* L.).

This section is represented in Nueva Galicia by six species: *C. fantzianus* Seym., *C. guatemalensis* Lotsy, *C. niveus* Jacq., *C. pseudoniveus* Lundell, *C. reflexifolius* H. B. K., and *C. schiedeanus* Schldl. They are readily distinguishable by the lepidote indumentum and well-developed petals in the ♀ flowers.

KEY TO THE SPECIES OF CROTON SECTION ELUTERIA IN WESTERN MEXICO

1. Leaf-blades pinnately veined; stamens 9–11, filaments glabrous; ovary lepidote.
 - 3.1. *C. schiedeanus*.
1. Leaf-blades palmately veined; stamens 10–18, filaments glabrous or hirsutulous.
 2. Ovary stellate-tomentose; scales often porrect; fruiting pedicel 4–5 mm long. 3.2. *C. niveus*.
 2. Ovary lepidote; scales never porrect (except in *C. fantzianus*).
 3. Stamens 10 or 11; fruiting pedicel 1–2 mm long; leaf blades sparsely lepidote abaxially. 3.3. *C. pseudoniveus*.
 3. Stamens 13–18; fruiting pedicel 1–15 mm long or more; leaf blades densely lepidote abaxially.

- 4. Fruiting pedicel 1–3 mm long; bracts of ♂ flowers 2–2.5 mm long; scales sometimes porrect; seeds 7.5–8 mm long. 3.4. *C. fantzianus*.
- 4. Fruiting pedicel 5–12 (–15) mm long; bracts of ♂ flowers 0.5–2 mm long; scales never porrect.
- 5. Inflorescences 8–22 cm long; fruits and seeds >10 mm long. 3.5. *C. guatemalensis*.
- 5. Inflorescences not over 6 cm long; fruits and seeds less than 10 mm long. 3.6. *C. reflexifolius*.

3.1 *Croton schiedeanus* Schtdl., *Linnaea* 19: 243. 1847.—TYPE: MEXICO. Veracruz: Misantla, *Schiede 1126* (holotype: HAL!).

This species, widespread mainly in lowland rain forests on the Gulf side of Mesoamerica from Veracruz to Panama and northern South America, is very rare in western Mexico, where it is known only from two stations in Nayarit.

SPECIMEN EXAMINED. NAYARIT: Mpio. Compostela, 1–1.5 mi above Cucaracha, *McVaugh 19200* (MICH); Mpio. San Blas, 2 km W of Cora towards Jalcocotán, *Téllez 10057* (DAV, MEXU).

3.2 *Croton niveus* Jacq., *Enum. Syst. Pl.* 32. 1760.—TYPE: COLOMBIA. Cartagena, 1857, *Schott s.n.* (neotype, here designated: MO 1905037!).

Croton syringifolius Kunth in H. B. K., *Nov. gen. sp.* 2: 67. 1817.—TYPE: COLOMBIA. Bolívar: Turbaco, *Humboldt & Bonpland 1437* (holotype: P-HBK!).

Croton septemnervius McVaugh, *Brittonia* 13: 165. 1961.—TYPE: MEXICO. Colima: Manzanillo, *Palmer 1058* in 1890 (holotype: MICH!).

Although the synonymy of *C. niveus* is not extensive, this widespread Caribbean and Mesoamerican species has been confused with various other species of sect. *Eluteria*. Unfortunately, no specimen of Jacquin appears to have survived, and his original diagnosis of 1760 is very inadequate: “foliis ovato-cordatis, serrulatis, dorso tomentosis.” In his book of 1763, Jacquin gave an illustration of a leaf and detailed description, which do seem to fit *C. niveus* as understood by most taxonomists.

In describing *Croton septemnervius* from FNG, McVaugh (1961) may have been misled by the treatment of Müller (1866: 518), who described the fruits of *C. niveus* as “lepidoto-puberulis” and those of *C. reflexifolius* as “molliter echinatis.” In fact, under the name *C. septemnervius* McVaugh provided the first accurate illustration and description of the stellate ovarian trichomes of *C. niveus* contrasted with the lepidote ones of *C. reflexifolius* and other Mexican taxa of sect. *Eluteria*. Burger and Huft (1995) question the consistency of this stellate vs. lepidote ovarian character, but examination of many specimens of *C. niveus* and other related species suggests that it does hold, as accepted by Gómez-Pompa (1966) and Howard (1989).

Although *C. niveus* is widespread from Mexico (Tamaulipas) south through Central America and the West Indies to northern South America, it has not been recorded from Michoacán, Nayarit, and Sinaloa. Usually it grows in lowland deciduous tropical woodland below 300 m, but occasionally ascends to nearly 1000 m.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Guadalupe Ayala 1208*, *Lott et al. 3645, 3700* (MICH, MO); Mpio. Cihuatlán, Playa de Cuastecomate, 8 km NW of Navidad, *McVaugh & Koelz 1698* (MICH).—COLIMA: Mpio. Manzanillo, 14 mi WNW of Santiago, *McVaugh 20765* (MICH).

- 3.3. *Croton pseudoniveus*** Lundell, *Phytologia* 1: 449. 1940.—TYPE: MEXICO. Sinaloa: Mpio. Rosario, Los Labrados, *Mexia* 921 (holotype: MICH!; isotype: UC!).

Recorded from Sonora south to Panama, this species is especially common in tropical deciduous woodlands along the Pacific lowlands (to 500 m) from Jalisco to Chiapas; curiously, it is unrecorded from Nayarit.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Baila, Abuya, *González Ortega* 6567 (GH); Mpio. Pericos, Cerro Tecomate, *Gentry* 5722 (GH); Mpio. Mazatlán, Mazatlán, *González Ortega* 2027 (MO).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott* 2862 (MICH, MO).—COLIMA: Mpio. Colima, 10–11 mi S of Colima, *McVaugh & Koelz* 1051 (MICH), *Webster & Breckon* 16094 (DAV, MICH).

- 3.4. *Croton fantzianus*** Seymour, *Phytologia* 43: 171. 1979.—TYPE: NICARAGUA. Nueva Segovia: Dipilto, *Budier* 6390 (holotype: FLAS; isotypes: DAV! MO! UC!).

This species, which superficially resembles *C. pseudoniveus*, has been misidentified throughout much of its range. It occurs sporadically (below 1000 m) from Sonora to Oaxaca and then is disjunct to Nicaragua and Costa Rica, although it will probably be collected in northern Central America. It clearly differs from *C. pseudoniveus* in a number of characters, including bract size, number of stamens, and size of seeds. Apparently its closest relationship may be with *C. niveus*, with which it shares a porrect indumentum; however, it differs from that species in having more compact inflorescences, shorter fruiting pedicels, and larger seeds.

The distribution and characters of *C. fantzianus* suggest the possibility that it could be of hybrid origin following crosses between *C. niveus* and *C. pseudoniveus*. However, arguing against the hypothesis of a recent hybrid origin is the presence of the aberrant form of *C. fantzianus* in Sonora (Steinmann & Felger 1997), where *C. niveus* has not been collected.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, Cerro la Calera, 12–14 km NW of Alamos, *Steinmann et al.* 94-154, *Van Devender et al.* 93-334 (DAV).—JALISCO: Mpio. San Martín de Bolaños, 11 km NE of Bolaños, *Lott et al.* 2108 (MEXU, TEX).

- 3.5. *Croton guatemalensis*** Lotsy, *Bot. Gaz.* 20: 353. 1895.—TYPE: GUATEMALA. Santa Rosa: Santa Rosa, *Heyde & Lux* 3035 (holotype: F!).
C. eluterioides Lotsy, *Bot. Gaz.* 20: 352. 1895.—TYPE: GUATEMALA. Santa Rosa: Santa Rosa, *Heyde & Lux* 3470 (holotype: F!).
C. pyriticus Croizat, *J. Arnold Arb.* 26: 186. 1945.—TYPE: COSTA RICA. Cartago: El Alto RR station on road to Cartago, *Allen* 661 (holotype: A!).
C. wilburi McVaugh, *Brittonia* 13: 166. 1961.—TYPE: MEXICO. Jalisco: 10 mi S of Autlán, *Wilbur & Wilbur* 2431 (holotype: MICH!).

The large-fruited North American species of sect. *Eluteria* that occur in cloud forests above 1500 m have been poorly understood, partly because material with both flowers and fruits is usually necessary for identification. Croizat (1942) regarded *C. guatemalensis* and *C. eluterioides* as different species, with the latter being distinguished by larger rugose fruits. Croizat (1945) later described the large-fruited form as *C. pyriticus*, but provided no distinguishing characters. Standley and Steyermark (1949) placed *C. eluterioides* in synonymy under *C. guatemalensis*; this is a rather unfortunate choice, because as pointed out by Croizat

(1942), the type material of *C. guatemalensis* lacks fruits. There is therefore some ambiguity in the application of the name, but in the absence of any countervailing evidence, the decision of Standley and Steyermark is followed here.

The plants in Nueva Galicia, named *C. wilburi* by McVaugh (1961), are distinctive in their larger coarser leaves, but in both flowers and fruits agree with *C. guatemalensis*. Whether *C. wilburi* can be recognized at a lower taxonomic level must await a critical revision of sect. *Eluteria*.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Autlán, 9 km E of Casimiro Castillo, *Iltis & Santana 30114* (MICH).—COLIMA: Cerro Grande, 3.5 km SW of El Terrero, *Cochrane et al. 11746* (IBUG, WIS).

3.6. *Croton reflexifolius* Kunth in H. B. K., Nov. gen. sp. 2: 68. 1817.—TYPE: MEXICO. "In maritimis prope Acapulco," *Humboldt & Bonpland* (holotype: P-HBK!).

As construed here, *C. reflexifolius* is widespread in Mexico and perhaps occurs in Guatemala as well. It has been confused with both *C. niveus* and *C. guatemalensis*. Although it is usually readily distinguished from *C. niveus* by its lepidote ovarian scales and lack of porrect trichomes, the populations in Tamaulipas closely mimic that species in general aspect. *Croton reflexifolius* is less easily differentiated from *C. guatemalensis*, as pointed out by Burger and Huft (1995). There seems to be an ecological difference between the species; *C. reflexifolius* occurs mainly in drier forests below 1000 m and *C. guatemalensis* mostly in cloud forests above 1000 m. Yet, as indicated by Gómez-Pompa (1966), some collections from above 1000 m in Guatemala appear to be referable to *C. reflexifolius*. Clearly, more critical study of specimens in Chiapas and Guatemala is needed.

REPRESENTATIVE SPECIMEN. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *McVaugh 26256* (MICH).

4. *Croton* section *Corylocroton* G. L. Webster, Taxon 42: 806. 1993.—TYPE: *Croton corylifolius* Lam.

This relatively small group of a half dozen Caribbean species is very close to sect. *Ocalia*, and both sections may be regarded as the American equivalents of the Old World sect. *Croton*. There are two species in western Mexico.

KEY TO SPECIES OF CROTON SECTION CORYLOCROTON IN WESTERN MEXICO

Fruiting pedicel 1–1.5 mm long; inflorescence with 3–7 ♀ flowers; seeds 2.9–3.3 mm long.

4.1. *C. mcvaughii*.

Fruiting pedicel 3–5 mm long; inflorescence with 1 or 2 ♀ flowers; seeds 4 mm long.

4.2. *C. repens*.

4.1. *Croton mcvaughii* G. L. Webster, sp. nov.—TYPE: MEXICO. Jalisco: Mpio. Cabo Corrientes, 5 km N of El Tuito, *McVaugh 25521* (holotype: MICH!).

Arbuscula monoica 0.7–1.5 m alta; foliis ovatis vel ovato-lanceolatis, 3–9.5 cm longis, 2–5.5 cm latis, petiolis 3–9 mm longis; inflorescentiae 3–5 cm longae, ad basin floribus ♀ 3–7; pedicelli fructiferi 1–1.5 mm longi; semina 2.9–3.3 mm longa.

It is highly appropriate to dedicate a new species to Rogers McVaugh, whose previous study of *Croton* in Nueva Galicia was an indispensable reference for the treatment in FNG. Although closely related to the widespread *C. repens*, *C. mcvaughii*

differs in its larger more pointed leaves, inflorescence with 3–7 (instead of 1 or 2) ♀ flowers, and smaller seeds. It has been recorded from oak woods and mixed broadleaf montane forest at 200–300 m.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. San Blas, 5 km NE of Miramar, *Téllez* 9772 (DAV).—JALISCO: Sierra las Vigas, San Juan Casalá, *Machuca Núñez* 4456 (WIS); Mpio. Jocotepec, Cerro Viejo, Zapotitán de Hidalgo, *Machuca Núñez* 6375 (MICH).

4.2. *Croton repens* Schltdl., *Linnaea* 19: 237. 1847.—TYPE: MEXICO. Veracruz: Hacienda de La Laguna, *Schiede* 40 (holotype: B, destroyed; lectotype, here designated: HAL!).

Although placed in sect. *Cascarilla* by Webster (1993), this species seems to fit sect. *Corylocroton* by virtue of its coarsely dentate, palmately veined leaves. It is widespread in oak savannas from Nayarit to Central America, mostly at elevations below 1000 m.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Nayar, 1 km N of Mesa de Nayar, *Steinmann* 1062 (DAV); Mpio. San Blas, 2–9 mi W of Jalcocotán, *McVaugh & Koelz* 694 (MICH).—JALISCO: Mpio. Zapopan, 10 km N of Tesistán, *Cházaro & Flores* 6303 (TEX).

5. *Croton* section *Anadenocroton* G. L. Webster, *Taxon* 42: 806. 1993.—TYPE: *Croton axillaris* Müll. Arg.

Section *Anadenocroton* comprises nine or ten species, occurring from western Mexico to northern South America, and is represented by two species in western Mexico.

KEY TO THE SPECIES OF CROTON SECTION ANADENOCROTON IN WESTERN MEXICO

- Inflorescences terminal; leaf blades obtuse to rounded at base, stipules 0.5–1 mm broad (not foliose). 5.1. *C. acapulcensis*.
 Inflorescences axillary; leaf blades ± cordate at base, stipules foliose, 1–2.5 mm broad. 5.2. *C. alamosanus*.

5.1. *Croton acapulcensis* Martínez Gordillo & J. Jiménez-Ram., *Anales Inst. Biol. Univ. Nac. Autón. México, Bot.* 60: 40. 1990.—TYPE: MEXICO. Guerrero: Mpio. Acapulco, Parque Nacional “El Veladero,” *Noriega* 599 (holotype: FCME; isotype: MEXU).

This species resembles *C. sutup* Lundell from eastern Mexico, but differs in its larger stamen number and shorter fruiting pedicels. Martínez Gordillo (1995) recorded *C. acapulcensis* only from Guerrero, but specimens collected in lowland deciduous woodlands of coastal Jalisco appear to represent this species.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Ayala & Lott* 24, *Lott* 3836 (DAV, MICH), *Gentry & Woodruff* 74399 (MO).

5.2. *Croton alamosanus* Rose, *Contr. U.S. Nat. Herb.* 1: 111. 1891.—TYPE: MEXICO. Sonora: Alamos, *Rose* 742 (lectotype, here designated: US!).
Croton blasianus M. E. Jones, *Contr. W. Bot.* 18: 49. 1933.—TYPE: MEXICO. Sinaloa: San Blas, *Jones* 23304 (holotype: POM).

Croton alamosanus is common in the deciduous thorn scrub of the Pacific lowland of western Mexico and sympatric with *C. acapulcensis* in the Chamela area. It is easily distinguished from *C. acapulcensis* by its foliose stipules, dioecious populations, and axillary inflorescences. It seems closer to *C. axillaris* Müll. Arg., a Gulf Coast species distributed from Veracruz to Nicaragua. Usually the latter species may be separated by its leaves with longer petioles and non-foliose stipules.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, Arroyo Las Rastras, *Van Devender et al.* 93-1463 (DAV).—SINALOA: Mpio. Guamúchil, 10 mi N of Guamúchil, *Dressler* 976 (MO); Mpio. Culiacán, Altata, *Gentry* 5442 (MICH, MO); Mpio. Mazatlán, vicinity of Mazatlán, *Wright* 1250 (MO).—NAYARIT: Mpio. Nayar, Los Sabinos, *Lomeli Sención* 2116 (DAV).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock* 1272, *Lott* 1102 (DAV, MICH).—MICHOACÁN: Mpio. Aquila, Titzupan, *Hinton* 13824 (DAV, GH, MO).

6. *Croton* section *Cascarilla* Griseb., Fl. Brit. W. Ind. 38. 1859. *Cascarilla* Adans., Fam. pl. 2: 355. 1763.—TYPE: *Croton cascarilla* (L.) L. (based on *Cluytia cascarilla* L.).

It is indicative of the biogeographic distinctiveness of the taxa of *Croton* in western Mexico that there is only a single local species belonging to the largest neotropical section.

6.1. *Croton ortegae* Standl., Field Mus. Publ. Bot. 22: 35. 1940.—TYPE: MEXICO. Sinaloa: Mpio. Mazatlán, Loma Atravesada, *Ortega* 7019 (holotype: F-670991!; isotype: US!).

This apparently rare species is known only from the type collection, and no ♂ flowers have been seen. Its systematic position, therefore, remains problematical. Specimens of *C. culiacanensis* Croizat appear similar, but differ in smaller fruiting calyces with finer tomentum, and lack stipitate glands at the base of the leaf blade.

7. *Croton* section *Velamea* Baillon, Adansonia I, 4: 316. 1864.—LECTOTYPE, designated by Webster, 1993: *Croton campestris* A. St.-Hil.

With nine species and several varieties, sect. *Velamea* is the largest and most complex group of *Croton* within FNG. It also presents the greatest number of taxonomic difficulties. There are evidently two species groups, which (pending a revision of all North American species of sect. *Velamea*) are not given formal designation at this time: Group 1, with entire leaves often copiously pubescent abaxially; and Group 2, with dentate sparsely pubescent leaves.

Group 1 includes a variety of forms that have mostly passed under the names *Croton flavescens* Greenm., *C. fragilis* H. B. K., *C. morifolius* Willd., *C. rzedowskii* M. Johnston, and *C. sphaerocarpus* H. B. K. Prolonged study of this complex suggests that most plants in FNG are referable to two polymorphic species, *C. morifolius* Willd. and *C. roxanae* Croizat. The relationship of the plants in Baja California with those on the mainland remains rather problematic, but it appears that *C. caboensis* and *C. magdalenae* may be the only species confined to Baja California (and offshore islands).

KEY TO THE SPECIES OF CROTON SECTION VELAMEA IN WESTERN MEXICO

1. Twigs stiffly hispid (hairs 2–2.5 mm long); leaf blades entire, strigose adaxially, appressed-stellate abaxially; pedicel and calyx of ♂ flowers stellate-pubescent. 7.8. *C. tremulifolius*.
1. Twigs appressed-stellate to hirsute or hispid (but then hairs less than 2 mm long); leaf blades entire or dentate, strigose or stellate-pubescent adaxially, appressed-stellate to tomentose abaxially; pedicel and calyx of ♂ flowers glabrous to pubescent.
 2. Leaves irregularly dentate, cordate, thick, copiously stellate-pubescent; stipules obscure; seeds 6–7 mm long. 7.3. *C. magdalенаe*.
 2. Leaves entire, rounded to cordate at base, thin, sparsely to copiously pubescent; stipules absent to prominent; seeds often less than 6 mm long.
 3. Stipules subulate, (1–) 2–5 mm long; pedicel and calyx of ♂ flowers stellate-pubescent; leaf blades with the apex ± abruptly cuspidate or acuminate (acumen 1–2 cm long), often with a subulate mucro, generally with the base cordate; petioles mostly >1 cm long; inflorescences mostly at least 5 cm long. 7.2. *C. morifolius*.
 3. Stipules rudimentary or absent; pedicel and calyx of ♂ flowers stellate-pubescent to almost glabrous; leaf blades rarely with the apex abruptly cuspidate or the base cordate; petioles mostly <1 cm long; inflorescences mostly <5 cm long.
 4. Pedicel and calyx of ♂ flowers stellate-pubescent.
 5. Leaf blades stellate-pubescent adaxially, stellate-tomentose abaxially; seeds 4.2–5.2 mm long. 7.1. *C. mazapensis*.
 5. Leaf blades stellate-pubescent or ± strigose adaxially, stellate-pubescent abaxially, never tomentose; seeds mostly 5 mm long or more.
 6. Receptacle of ♂ flowers glabrous or nearly so; petioles glabrous to stellate-pubescent, not porrect-hispid; seeds 5–5.8 mm long; leaf blades stellate-pubescent adaxially. 7.5. *C. sonora* [variant with pubescent ♂ pedicels].
 6. Receptacle of ♂ flowers moderately villose; petioles ± porrect-hispid; seeds 5.5–6.5 mm long; leaf blades ± strigose adaxially. 7.6. *C. caboensis*.
 4. Pedicel of ♂ flowers glabrous or nearly so; calyx of ♂ flowers glabrous to sparsely stellate.
 7. Leaf blades lanceolate, entire, ± attenuate-acuminate.
 8. Leaf blades glabrescent adaxially, strigose when young; twigs sparsely stellate to nearly glabrous; lower nodes of inflorescence often with ♂ flowers accompanying the ♀ flowers; seeds 3.8–4.6 mm long. 7.4. *C. roxanae*.
 8. Leaf blades stellate-scabrid adaxially; twigs densely porrect-hispid; lower nodes of inflorescence with ♀ flowers only; seeds 5–6.5 mm long. 7.5. *C. sonora*.
 7. Leaf blades ovate to elliptic, denticulate or coarsely dentate, obtuse or acute to abruptly acuminate.
 9. Twigs appressed-stellate (stellate-tomentose on autumn twigs); leaf blades denticulate, petioles mostly 1–2 cm long; stamens 10 or 11; styles 4–6 mm long, glabrous. 7.7. *C. adpersus*.
 9. Twigs glabrous; leaf blades coarsely dentate, petioles mostly 3–7 cm long; stamens 13–15; styles ca. 3 mm long, sparsely stellate. 7.9. *C. ynesae*.

GROUP 1. Leaves on flowering axes entire; stipules relatively well developed (0.5–3 mm long).

7.1. *Croton mazapensis* Lundell, Contr. Univ. Michigan Herb. 7: 19. 1942.—TYPE: MEXICO. Chiapas: between Mazapa and Motozintla, *Matuda* 4834 (holotype: MICH!).

This species is morphologically very similar to *C. morifolius*; there appear to be no consistent differences in the reproductive structures. *Croton mazapensis* is sympatric with *C. morifolius* over large areas, but appears to grow in generally drier habitats. It seems expedient, therefore, to maintain it as a distinct species. Studies of the FNG specimens indicate that two varieties can be distinguished.

- 7.1a. *Croton mazapensis* var. *obtusifolius*** (Müll. Arg.) G. L. Webster, comb. nov.
Croton morifolius var. *obtusifolius* Müll. Arg. in DC., Prodr. 15(2): 641. 1866.—TYPE: MEXICO. Oaxaca, *Andrieux 109* (holotype: G).
Croton gonzalezii Greenm., Proc. Amer. Acad. Arts 39: 81. 1903.—TYPE: MEXICO. Jalisco: Mpio. San Juan Bautista Cuicatlán, Cuicatlán, *V. González 980* (holotype: GH!).
Croton rzedowskii M. C. Johnston, Brittonia 20: 227. 1968.—TYPE: MEXICO. San Luis Potosí: Rioverde to San Ciro, *Rzedowski 4543* (holotype: MICH!).

When he described *C. rzedowskii*, Johnston (1968) commented that it was close to *C. mazapensis*. This seems evident, and it appears better to regard *C. rzedowskii* as an allopatric variety distinguished by a few characters, such as shorter inflorescences with a smaller number of ♀ flowers. This variety barely enters the FNG area in upland savannas in Zacatecas, at 1500–2000 m.

REPRESENTATIVE SPECIMENS. ZACATECAS: Mpio. Jalpa, 5 mi SW of Jalpa, *McVaugh 18503*, *Rzedowski 14205* (MICH).

- 7.1b. *Croton mazapensis* var. *pacificus*** G. L. Webster, var. nov.—TYPE: MEXICO. Jalisco: Mpio. La Huerta, Cerro Pedregoso, *Pérez J. 1809* (holotype: DAV!).

Croton mazapensis var. *pacificus* ab var. *obtusifolius* differt ramulis non hirtellis, foliis acutis non mucronulatis.

In contrast to var. *obtusifolius*, which is found in open grassy terrain at much higher elevations (1500 m and above), var. *pacificus* appears to be restricted to lowland (<100 m) deciduous scrub or woodland. So far, there are only a few known collections of var. *pacificus*, all from the coast between southwestern Jalisco and Mazatlán (Sinaloa).

A remarkable specimen from near Mazatlán (*Eyerdam & Beetle 8683*, UC) probably represents var. *pacificus*, although the leaf blades are glabrous adaxially and tomentose abaxially, as in the eastern Mexican *Croton cortesianus* Kunth; however, the Sinaloan specimen differs from that species in its bisexual inflorescences and appressed stem pubescence. It may be an aberrant form of var. *pacificus*, but needs further study in the field.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Cumbres de Cuixmala, El Salto, *Acevedo 998* (DAV).—SINALOA: hill of wireless station, Mazatlán, *Ferris 50006* (DS); Mpio. Mazatlán, Mazatlán, *Howell 10547* (CAS).

- 7.2. *Croton morifolius*** Willd., Sp. pl. 4: 535. 1805.—TYPE: VENEZUELA: Cumaná, *Humboldt & Bonpland* (holotype: B-W-17854!).

This common species extends from the Pacific and Gulf coastal slopes of Mexico to northern Colombia and Venezuela. It occurs in seasonal forest and scrub, and sometimes reaches cloud forest above 1000 m. In Mexico, there are three varieties, all represented in the FNG area. One or more of these taxa have been recognized as distinct species (e.g., by Martínez-Gordillo 1995), and their rank is still subject to investigation. I believe that because there are indications of intergradation among the three, they are best treated as varieties.

KEY TO THE VARIETIES OF *CROTON MORIFOLIUS*

1. Twigs appressed-stellate (dendritic hairs rare or absent); ovary and capsule rounded or angled, indumentum of ovary whitish or yellowish.
 2. Ovary and capsule distinctly angled. 7.2a. *C. morifolius* var. *brandegeanus*.
 2. Ovary and capsule rounded. 7.2b. *C. morifolius* var. *morifolius*.
1. Twigs floccose with stipitate-stellate and dendritic hairs; ovary and capsule rounded, indumentum $\pm$ brownish. 7.2c. *C. morifolius* var. *sphaerocarpus*.

7.2a. *Croton morifolius* var. *brandegeanus* (Croizat) G. L. Webster, comb. nov.
Croton flavescens var. *brandegeanus* Croizat, J. Arnold Arb. 26: 187. 1945.—TYPE: MEXICO. Sonora: 4 mi N of Nacori, *Wiggins & Rollins* 391 (holotype: A!).

Croton flavescens Greenm., Proc. Amer. Acad. Arts 39(5): 81. 1903.—TYPE: MEXICO. Michoacán: Monte León, *Pringle* 8667 (holotype: GH!).

Although mature specimens of var. *brandegeanus* are very easily recognized by the angular ovaries and fruits, vegetatively the plants are almost indistinguishable from var. *morifolius*. In general, var. *brandegeanus* occurs further to the north and west in Mexico than the other two varieties; it occurs in a surprisingly wide range of habitats, from tropical deciduous forest to cloud forest, at elevations of 150–1600 m. In the FNG area, it is to some extent sympatric with var. *sphaerocarpus*, but the two have not been found at the same locality.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, San Bernardo, *Gentry* 1488 (UC).—CHIHUAHUA: Mpio. Batopilas, La Bufa, *Soulé* 572 (MO); Areponapuchic, Barranca de Urique, *Knobloch* 1341 (MICH).—SINALOA: Mpio. Culiacán, Culiacán, 18 Aug 1904, *Brandegee s.n.* (UC); Mpio. Rosario, El Monte, near Los Labrados, *Mexia* 929 (MO).—NAYARIT: Mpio. Nayar, Jesús María, *Norris & Taranto* 13948 (MICH).—ZACATECAS: Mpio. Moyhahua, San José, *Rzedowski* 20252 (MICH).—JALISCO: Mpio. Tuxcacuesco, 5–6 km ENE of Zenzontla, *Santana & Benz* 5907 (DAV, WIS).—MICHOCÁN: Mpio. Apatzingán, canyon below Acahuato, *Leavenworth & Hoogstraal* 1545, 1550 (MO).

7.2b. *Croton morifolius* var. *morifolius*. *Croton morifolius* var. *genuinus* Müll. Arg., Linnaea 34: 125. 1865.

Croton sericeus Schltdl. & Cham., Linnaea 5: 85. 1830, non *Croton sericeus* Lam., 1786. *Croton deppeanus* Steud., Nomencl. Bot., ed. 2, 1: 446. 1840. *Croton fragilis* [var.] *sericeus* (Schltdl. & Cham.) Müll. Arg. in DC., Prodr. 15(2): 642. 1866.—TYPE: MEXICO. Veracruz: Plan del Río, *Schiede* 59 (holotype: HAL!).

This is the most widespread of the varieties, occurring from eastern Caribbean Venezuela north to Nayarit and Veracruz. Generally, it is found in deciduous woodlands at lower elevations (usually below 1000 m) than the other two varieties. In the FNG area, it has been recorded in a few localities in Nayarit, Jalisco, and Colima. Specimens from Veracruz, including the type of *C. sericeus* Schltdl. & Cham., are distinctive in their larger leaves, often with an elongate apical mucro; it is possible that further study may demonstrate that they are varietyally distinct.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tepic, Colorado de la Mora, *Lomelí Sención* 2062 (DAV).—JALISCO: Mpio. La Huerta, Cuixmala, Cerro de Alborada, *Castillo* 5314 (DAV).—COLIMA: Mpio. Colima, 5 mi S of Colima, *McVaugh* 15507 (MICH).

7.2c. *Croton morifolius* var. *sphaerocarpus* (Kunth in H. B. K.) Müll. Arg., *Linnaea* 34: 125. 1865. *Croton sphaerocarpus* Kunth in H. B. K., *Nov. gen. sp.* 2: 84, pl. 105. 1817.—TYPE: MEXICO. Michoacán: Volcán Jorullo, *Humboldt & Bonpland s.n.* (holotype: P-HBK!, fragment: A!).

Although it extends to Nayarit and Zacatecas, this variety occurs in gallery and tropical montane forests, generally at higher elevations (up to 1900 m) than the other two; it is the only variety found in the Sierra Madre Oriental in Querétaro, Puebla, and Hidalgo. A good argument could be made for recognizing it as a distinct species.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Ahuacatlán, 5–10 mi SE of Ahuacatlán towards Barranca del Oro, *Feddema* 272, *McVaugh* 16359 (MICH).—JALISCO: Mpio. Tapalpa, El Salto, Río Jiquilpan, *Lott* 374 (MICH).—COLIMA: Mpio. Comala, Rancho El Jabalí, 22 km NW of Colima, *Lott* 2912, *Vázquez* 476, *Sanders* 10324 (MICH).—MICHOCÁN: Mpio. Sahuayo, 8 mi NW of Sahuayo, *McVaugh* 18190 (MICH).—GUANAJUATO: Mpio. León, 4.5 km ENE of Alfaro, *Galván* 3087 (MO).

7.3. *Croton magdalenae* Millsp., *Proc. California Acad. Sci.*, ser. 2, 2: 220. 1889.—TYPE: MEXICO. Baja California Sur: Isla Magdalena, 17 Jan 1889, *Brandegge s.n.* (holotype: F; isotype: UC!).
Croton boregensis M. E. Jones, *Contr. W. Bot.* 18: 48. 1933.—TYPE: MEXICO. Baja California Sur: Laguna Mts., Borrego Ranch, *Jones* 27496 (holotype: POM; isotype: UC!).

The most common woody *Croton* in Baja California, this species occurs from the Sierra Juárez south to Cabo San Lucas in lowland xeric scrub (from sea level to 700 m). It is similar in many ways to *C. morifolius*, but differs in its thicker ± obscurely dentate leaves, abaxially villose petals of ♂ flowers, and larger fruits and seeds. Plants on the islands in the Sea of Cortez have smaller, thicker leaves, but appear conspecific. Wiggins (1980) distinguished *C. boregensis* by its truncate rather than cordate leaf bases, but the leaves of the isotype are clearly cordate.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA: Sierra Juárez, Cañón Diablito, *Webster* 18264 (DAV).—BAJA CALIFORNIA SUR: Sierra de la Giganta, *Carter & Ferris* 3886 (DAV, UC); Sierra de la Victoria E of Todos los Santos, *Chambers* 887 (US); Cayuca Ranch, Loreto, *Jones* 27498 (MO); W of Volcán Las Tres Vírgenes, *Webster* 26163 (DAV). Isla del Carmen: Puerto Ballandra, *Wiggins* 17507 (DAV, DS); Agua Grande, *Johnston* 4143 (MO).

Steinmann and Felger (1997) reported *C. magdalenae* from Isla Tiburón, Sonora.

7.4. *Croton roxanae* Croizat, *J. Arnold Arb.* 21: 81. 1940.—TYPE: MEXICO. Nayarit: Islas Tres Marías, María Madre, *Ferris* 5601 (holotype: A!; isotype: DS!).

Leaf blades elliptic to lanceolate, caudate-acuminate, glabrescent adaxially (often becoming almost glabrous in age); stipules obsolete; pedicels of ♂ flowers glabrous or nearly so; inflorescences often with bisexual lower cymules.

There has been more confusion about the identity of this common species than any other species of *Croton* in FNG. It occurs mostly in lowland deciduous woodlands, but sometimes reaches oak forest above 1000 m. Most of the collections here referred to *C. roxanae* have been identified as *C. fragilis* H. B. K. or *C. rhamnifolius* H. B. K., both based on types from South America. The type material of *C. fragilis* from Cumaná, Venezuela (*Humboldt* 97, P-HBK!) was described by

Kunth as having the upper leaf surface stellate rather than strigose and the twigs tomentose-pilose, characters that do not suggest the plants from FNG. Furthermore, the type collection of *C. fragilis* is so imperfect that the identity of the species must remain doubtful; there seems little justification for applying the name *C. fragilis* to Mexican plants. *Croton rhamnifolius* (syntypes from Prov. Sucre, Venezuela, *Humboldt* in *Herb. Willdenow* 17853, B) presents problems of a different nature. It seems probable that several different species are included in Müller's very broad circumscription of 1866. The type variety, *C. rhamnifolius* sensu stricto, has tomentose stems, the leaves more short-pointed, and ♂ flowers with a puberulent calyx and copiously villose receptacle (in contrast to the nearly glabrous receptacle of *C. roxanae*). It appears that the least unsatisfactory alternative is to apply the name *Croton roxanae* to this highly variable complex of populations in western Mexico. There frankly remains some doubt about the relationship between the rather poorly known plants from the Islas Tres Marías and those on the mainland.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Rosario, Los Labrados, *Ferris & Mexia* 5242 (A).—NAYARIT: Mpio. San Blas, 12 mi NE of Singayta, *Webster & Lynch* 17071 (DAV, MICH).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock* 932, *Delgado* 294, *Lott & Ayala* 29, *Pérez* 683 (MICH).—COLIMA: Mpio. Manzanillo, gorge of Río Cihuatlán 13 mi N of Santiago, *McVaugh* 15837 (MICH).—MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton* 13850 (MICH).

7.5. *Croton sonorae* Torrey in Emory, Rept. Bot. Mex. Bound. Surv. 194. 1859.—

TYPE: MEXICO. Sonora: "Sierra de Nayos," Jul 1855, *A. Schott s.n.* (holotype: NY, photograph: DAV!).

Croton pringlei S. Watson, Proc. Amer. Acad. Arts 20: 373. 1885.—TYPE: MEXICO. Sonora: "northwestern mountains," *Pringle* 569 (holotype: GH!; isotype: US!).

Croton attenuatus M. E. Jones, Contr. W. Bot. 18: 47. 1933.—TYPE: MEXICO. Baja California Sur: Sierra Giganta, Cayuca ranch, *Jones* 27500 (holotype: RSA).

This species, common in the Sonoran Desert, is typically easy to recognize by its small rigid leaves with sparse scabrid indumentum. Larger-leaved forms, such as occur in Baja California, can mimic *C. roxanae* or forms of *C. mazapensis*. However, usually the pedicel of ♂ flowers is stellate-pubescent in *C. sonorae*, and the seeds are larger than in *C. roxanae*. The absence of *C. sonorae* from Sinaloa is unexpected, in view of its presence in Baja California Sur. It is also surprising that *C. sonorae* is sympatric with *C. caboensis* and *C. magdalенаe* in Baja California Sur, but does not occur further north in the peninsula.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Sierra de la Giganta, S of Tinaja de Naucajoa, *Carter* 4480 (DAV, UC); Mesa del Protrero de San Javier, *Carter* 4963 (UC); 17 mi S of La Paz, *Webster & Murphey* 24344 (DAV).—SONORA: Mpio. Guaymas, Punta Narizón, *Webster & Dehgan* 19747 (DAV).

7.6. *Croton caboensis* Croizat, J. Arnold Arb. 26: 181. 1945.—TYPE: MEXICO. Baja California Sur: Todos Santos, 4 Oct 1899, *Brandegge s.n.* (holotype: UC!).

Croizat characterized this species as an outstanding segregate from the "group of *C. fragilis*" because of its strigose leaves, large seeds, and hispid ovary. These characteristics are indeed distinctive in separating it from *C. mazapensis* and *C. morifolius*. In semi-xeric deciduous woodlands and scrub in Baja California Sur *C. caboensis* is sympatric with both *C. magdalенаe* and plants referred to *C. sonorae* by Annetta Carter.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Sierra de la Giganta, 3.5 km NE of San José de Agua Verde, *Carter 4834* (DAV, MO, UC); Cañón de la Cumbre, *Carter 4849* (MO, UC); San José del Cabo, *Brandeggee 549* (UC).

GROUP 2. Leaves on flowering axes serrulate to coarsely dentate, stipules rudimentary.

In contrast to the taxa of Group 1, the species of Group 2 are restricted to northern Mesoamerica. *Croton adpersus* Benth. reaches Guatemala at its southern limit, *C. ynesae* Croizat is found from Jalisco to Guerrero, and *C. tremulifolius* Croizat is endemic to Colima. A character of possible systematic importance is the production of smaller densely tomentose leaves during the dry season in both *C. adpersus* and *C. ynesae*; possibly *C. tremulifolius* will show the same behavior. Apparently, comparable short-shoots with densely tomentose leaves do not occur in taxa of Group 1.

7.7. *Croton adpersus* Benth., Pl. Hartwegianae 51. 1840.—TYPE: MEXICO. Michoacán: Morelia, *Hartweg 389* (holotype: K!).

Croton calvescens S. Wats., Proc. Amer. Acad. Arts 26: 147. 1891.—TYPE: MEXICO. Jalisco: Chapala, *Palmer 706* in 1886 (holotype: GH!).

Croton botryocarpus Croizat, Field Mus. Publ. Bot. 22: 445. 1942.—TYPE: GUATEMALA. Jalapa: Jalapa, *Standley 77519* (holotype: A!).

Croton adpersus is widespread and common in oak-pine forests above 1500 m in the Sierra Volcánica Transversal, in Mexico from Jalisco to Chiapas and in Guatemala.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Tapalpa, 1–2 mi E of Tapalpa, *McVaugh 20515* (MICH).—MICHOCÁN: Mpio. San José de Gracia, 6 km NE of San José, *Rzedowski 15504* (MICH); Mpio. Tancítaro, 2 mi S of Tancítaro, *Leavenworth 603* (MO); Mpio. Morelia, 16 mi E of Morelia, *Webster & Breckon 16142* (DAV).

7.8. *Croton tremulifolius* Croizat, J. Arnold Arb. 21: 83. 1940.—TYPE: MEXICO. Colima: hill between Cuyutlán Lagoon and the ocean, *Ferris 6176* (holotype: A!; isotype: CAS!).

Croton tremulifolius is rare in coastal deciduous woods below 100 m in southern Jalisco and adjacent Colima. An anomalous specimen (*Sanders 8472*) from Rancho Jabalí, Colima, lacks hispid stems.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Playa Perula adjacent to Bahía Chamela, *Mayfield 1631* (DAV).—COLIMA: Mpio. Manzanillo, 5 km E of Manzanillo, *Díaz Luna 3324* (MICH); Playa Campos, 4–5 km S of Manzanillo, *Orcutt 4504* (CAS, MO).

7.9. *Croton ynesae* Croizat, J. Arnold Arb. 21: 83. 1940.—TYPE: MEXICO. Jalisco: Mpio. Puerto Vallarta, Santa Cruz de Vallarta, *Mexia 1279* (holotype: A!; isotype: MO!).

Croton ynesae occurs in mixed deciduous or oak forests at 300 to 1200 m from Nayarit to Guerrero.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Ruiz, between El Venado and Zopilote, *Breedlove & Almeda 45206, 60679* (CAS); Mpio. Santa María del Oro, lake NE of Santa María, *Feddema 753* (MICH), *Webster 19911* (DAV).—JALISCO: Mpio. Tecalitlán, 5 mi SW of Tecalitlán, *McVaugh 15451* (MICH).—COLIMA: Mpio. Minatitlán, 9 km NE of Minatitlán, *McVaugh 26235* (MICH).

- 8. *Croton* section *Geiseleria* (Klotzsch) Baillon, Étude Euphorb. 359. 1858.—**
TYPE: *Geiseleria chamaedryfolia* Klotzsch [= *Croton trinitatis* Millsp.].

There are five species of this section in western Mexico, two of them recently described. Steinmann (1998) pointed out that *C. cupuliferus* and his new species *C. martinianus* belong to sect. *Geiseleria*.

KEY TO THE SPECIES OF *CROTON* SECTION *GEISELERIA* IN WESTERN MEXICO

1. Leaf blades subentire.
 2. Shrub to 3 m, leaves stellate-lepidote abaxially; ♀ flowers appressed to inflorescence axis. 8.1. *C. chamelensis*.
 2. Perennial herb or subshrub less than 0.5 m; leaves stellate-lanate abaxially; ♀ flowers not appressed to inflorescence axis. 8.2. *C. varelae*.
1. Leaf blades coarsely dentate.
 3. Bracts subtending ♂ flowers <1 mm long, lacking bottle-shaped glands at base; sepals of ♀ flowers slightly unequal, linear to oblanceolate, the larger 2–2.5 mm long in fruit; leaf blades acuminate, strigose or appressed-stellate adaxially; seeds 3.5–4 mm long; scarcely woody shrub to 1 m high. 8.3. *C. cupuliferus*.
 3. Bracts subtending ♂ flowers at least 2 mm long, subtended by bottle-shaped glands; sepals of ♀ flowers distinctly unequal, linear to oblanceolate to spatulate, the larger >3 mm long in fruit; leaf blades obtuse to acute, stellate or tomentose on both faces; seeds 2.6–3.3 mm long; herbs mostly 0.5 m high or less.
 4. Perennials with appressed-stellate to tomentose stems; leaf blades sparsely to densely stellate-pubescent adaxially; receptacle of ♂ flowers densely villous; sepals of ♀ flowers oblanceolate to spatulate, the larger 3.5–4 mm long; seeds 3–3.3 mm long. 8.4. *C. martinianus*.
 4. Annuals with hirsute-hispid stems; leaf blades strigose adaxially; receptacle of ♂ flowers glabrous or nearly so; sepals of ♀ flowers linear to oblanceolate, the larger 4–6.5 mm long; seeds 2.6–3.1 mm long. 8.5. *C. hirtus*.

- 8.1. *Croton chamelensis*** E. J. Lott, Brittonia 39: 302. 1987.—**TYPE:** MEXICO. Jalisco: Mpio. La Huerta, Estación Biológica Chamela, *Pérez Jiménez 1391* (holotype: MEXU; isotype: DAV!).

This species, with disjunct stations in Nayarit, Jalisco, and Guerrero, appears to be restricted to deciduous woodlands at low elevations (<200 m). *Croton chamelensis* appears very different from the other local species and is closely related to *C. ramillatus* Croizat of eastern Mexico.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Nayar, La Nopalera, *Flores-Franco 2799* (MICH).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock 1924*, *Lott et al. 557, 1677, 1730* (MICH).

- 8.2. *Croton varelae*** V. W. Steinm., Aliso 19: 182. 2001.—**TYPE:** MEXICO. Nayarit: Mpio. Nayar, 1 km N of Mesa de Nayar, *Steinmann et al. 1063* (holotype: RSA; isotype: DAV!).

Croton varelae is known only from the type collection gathered in oak-pine woods at 1300 m. This species appears very distinct from the other Mexican taxa of sect. *Geiseleria*.

- 8.3. *Croton cupuliferus*** McVaugh, Brittonia 13: 163. 1961.—**TYPE:** MEXICO. Colima: Mpio. Manzanillo, 14 mi WNW of Santiago, *McVaugh 20771* (holotype: MICH!; isotype: DAV!).

Croton cupuliferus occurs in deciduous woodlands below 1000 m in Jalisco and Colima. This species is very similar in aspect to *C. martinianus*, but differs from that and the other species of sect. *Geiseleria* in the lack of bottle-shaped glands at the base of the bracts subtending the ♂ flowers. If it were not for its close resemblance to *C. martinianus*, it could be assigned to sect. *Corylocroton*.

REPRESENTATIVE SPECIMEN: JALISCO: Mpio. La Huerta, Chamela, Cerro Maderas, *Lott et al.* 1829 (DAV, MICH).

8.4. *Croton martinianus* V. M. Steinm., *Novon* 8: 81. 1998.—TYPE: MEXICO. Sonora: Mpio. Alamos, Sierra de Alamos, 2 km SW of Alamos, *Steinmann* 954 (holotype: ARIZ; isotype: DAV!).

Croton martinianus is found in tropical deciduous forest and oak woodland at 500–1200 m from southern Sonora to Jalisco. As noted by Steinmann (1998), there is dimorphism in leaf pubescence, the tomentose plants apparently developing during the dry season. This has not been noted in *C. cupuliferus*, unless the questionable specimens from northern Jalisco cited for *C. martinianus* really belong to *C. cupuliferus*.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, 2 km SW of Alamos (topotype), *Steinmann* 93-309 (DAV); Artoyo Gochico, ca. 10 km E of San Bernardo, *Steinmann et al.* 606 (DAV).—SINALOA: Mpio. Salvador Alvarado, N of Terrero, *Bojórquez* 688 (MEXU).—JALISCO: Mpio. San Cristóbal de la Barranca, 1 km NE of San Cristóbal, *Lomelí Sención* 2010 (DAV); Mpio. Zapopan, 30 km N of Zapopan, *Rodríguez et al.* 1416 (WIS).

8.5. *Croton hirtus* L'Her., *Stirp. nov.* 17, pl. 9. 1785. *Croton glandulosus* [var.] *hirtus* (L'Her.) Müll. Arg. in DC., *Prodr.* 15(2): 684. 1866. *Croton glandulosus* subsp. *hirtus* (L'Her.) Croizat, *Bull. Torrey Bot. Club* 75: 401. 1948.—TYPE: FRENCH GUIANA. *L. Richard* s.n. (syntypes: P-LA!; P-JU 16358!).

This widespread weed has often been confused with *C. glandulosus* L., which so far has not been encountered in western Mexico.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Culiacán, Sep 1904, *Brandege* s.n. (UC).—JALISCO: Mpio. La Huerta, just N of La Huerta, *Wilbur* 36715 (DUKE).—COLIMA: Mpio. Colima, Colima, *Palmer* 37 in 1897 (MICH, UC).—MICHOACÁN: Mpio. Aquila, Playa Cocula, *Wilbur* 36633 (DUKE).

9. *Croton* section *Gynamblosis* (Torr.) A. Gray, *Manual*, ed. 2, 392. 1856.—TYPE: *Croton monanthogynus* Michx.

9.1. *Croton pedicellatus* Kunth in H. B. K., *Nov. gen. sp.* 2: 75, pl. 104. 1817.—TYPE: PERU. Cajamarca: Pongo de Rentema, *Humboldt & Bonpland* (holotype: P-HBK).
Croton tenuilobus S. Wats., *Proc. Amer. Acad. Arts* 21: 439. 1886.—TYPE: MEXICO. Chihuahua: Hacienda San José, *Palmer* 29 (holotype: GH).

McVaugh (1961) appears correct in including *C. tenuilobus* in *C. pedicellatus*, which is widespread in South America, but in North America is known only from western Mexico in thorn forests or woodlands.

REPRESENTATIVE SPECIMENS. SONORA: 9.7 mi by road S of Nuri, *Turner & Goldberg 77-26* (UC).—NAYARIT: Mpio. Nayar, 32.5–40 km NE of Jesús María, *Flores & Tenorio 966, 1009* (DAV, MICH, MEXU).—JALISCO: Mpio. Chapala, 9 mi W of Chapala, *Webster & Lynch 17169* (DAV, MICH).—MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 12690* (MICH, UC).

- 10. *Croton* section *Julocroton* (Mart.) G. L. Webster, J. Arnold Arb. 48: 354. 1967. *Julocroton* Mart., Flora 20, Beibl. 2: 119. 1837.—TYPE: *Julocroton phagedaenicus* Mart. [= *Croton triqueter* Lam.]**

Although *Julocroton* was reduced to a section of *Croton* over thirty years ago (Webster 1967), it is still treated by some as a distinct genus.

KEY TO THE SPECIES OF CROTON SECTION JULOCROTON IN WESTERN MEXICO

- Annual herb with silvery foliage; leaf blades rounded to acute at apex; bracts entire; petals of ♂ flower glabrous; disk of ♀ flower asymmetrically lobed. 10.1. *C. argenteus*.
Shrub, foliage with brownish hairs; leaf blades acute to acuminate at apex; bracts apically laciniate; petals of ♂ flower pubescent; disk of ♀ flower lunate, entire. 10.2. *C. conspurcatus*.

- 10.1. *Croton argenteus* L., Sp. pl. 1004. 1753. *Julocroton argenteus* (L.) Didr., Vidensk. Meddel. Dansk Naturh. Foren. Kjøbenhavn 1857: 134. 1857.—TYPE: specimen in the Hortus Cliffortianus Herbarium (holotype: BM!).**

Croton argenteus ranges from southern Texas and Mexico to South America, but it is rare in western Mexico and apparently recently introduced there.

REPRESENTATIVE SPECIMEN. JALISCO: Mpio. La Huerta, 3 km W of Quémaro, *Guadalupe Ayala 916* (DAV).

- 10.2. *Croton conspurcatus* Schltdl., Linnaea 7: 380. 1832. *Julocroton conspurcatus* (Schltdl.) Klotzsch, Arch. Naturgesch. 7: 193. 1841. *Julocroton triqueter* var. *conspurcatus* (Schltdl.) Müll. Arg. in DC., Prodr. 15(2): 705. 1866.—TYPE: MEXICO. Veracruz: Tioselo [Teocelo], *Schiede 39* (holotype: HAL).**

Like *C. argenteus*, *C. conspurcatus* is common in eastern Mexico but rare and perhaps recently introduced into western Mexico.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Cumbres de Cuixmala, El Salto, *Acevedo et al. 999* (DAV, WIS); Mpio. Tuxcacuesco, 5–6 km ENE of Zenzontla, *Santana & Benz 5921* (DAV, WIS).

- 11. *Croton* section *Adenophyllum* Griseb., Fl. Brit. W. Ind. 40. 1859.—TYPE: *Croton adenophyllum* Spreng.**

This section, characterized by stipitate glands on leaves, stipules, and sometimes calyces, is represented by five species in western Mexico. Except for the common *C. ciliatoglanduliferus*, the species are poorly sampled and inadequately understood.

KEY TO THE SPECIES OF CROTON SECTION ADENOPHYLLUM IN WESTERN MEXICO

1. Leaf blades ovate to lanceolate, >1 cm broad; styles multifid; stamens 11–45.
2. Leaf blades with copious stipitate marginal glands, tomentose abaxially; stipules dissected into gland-tipped cilia 2–5 mm long; stamens 25–45. 11.1. *C. ciliatoglanduliferus*.

- 2. Leaf blades with scattered (usually very sparse) stipitate marginal glands, sparsely stellate-pubescent abaxially; stipules dissected into cilia 0.5–2 mm long; stamens 11–15.
- 3. Fruiting pedicel 4–5.5 mm long; seeds 5.2–5.6 mm long. 11.2. *C. jucundus*.
- 3. Fruiting pedicel 1.5–3.5 mm long; seeds 3.7–4 mm long. 11.3. *C. subjucundus*.
- 1. Leaf blades linear, <1 cm broad; styles bifid; stamens 10–16.
- 4. Leaf blades stellate-tomentose abaxially, margins often with stipitate glands; stipules glandular-dissected; bracts of ♂ flowers glandular-dissected; sepals of ♀ flowers with copious stipitate glands. 11.4. *C. yecorensis*.
- 4. Leaf blades stellate-lepidote abaxially, margins without glands; stipules rudimentary; bracts of ♂ flowers subulate, glandular at base; sepals of ♀ flowers sparsely glandular. 11.5. *C. michaelii*.

11.1. *Croton ciliatoglanduliferus* Ortega, Nov. pl. descr. dec. 51. 1797 (“*C. ciliatoglanduliferum*”). *Croton penicillatus* Vent., Choix pl. 12, pl. 12. 1803, nom. superfl.—TYPE: based on living material cultivated at the Madrid Botanical Garden from seed sent by Sessé.—[MEXICO.] “Nueva Espana,” Sessé & Mociño s.n. (neotype, here designated: G-Barbey-Boissier!).

This extremely common species, barely reaching southern Texas, is widespread in Mexico from Sonora and Tamaulipas to Chiapas and Quintana Roo, continuing into Central America. In Nueva Galicia, it is common in disturbed deciduous forest or scrub from sea level to 1800 m.

In the protologue, Ortega wrote “Habitat in Insula Cuba” and “é seminibus missis per D. Sessé”; however, the species is not known from Cuba, and presumably was grown from seeds collected in Mexico by Sessé and sent to Havana. From the discussions of McVaugh (2000), it appears that Sessé and Mociño collected the species in Mexico several times, but misdetermined it as *Croton humile* L.; this name was used on the plate Ic. Fl. Mex. 221 and DC. 1120. The specimen at G labelled *C. humile* by Pavón and determined by Müller Argoviensis as *C. ciliatoglanduliferus* is certainly authentic, and is here designated as the neotype. Additional specimens are enumerated by McVaugh (2000).

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Rancho San Antonio, E side of Sierra San Francisco, *Moran 23811* (DAV).—SONORA: Mpio. Alamos, 1 mi SW of Alamos, *Sanders 3671* (DAV).—SINALOA: Mpio. San Ignacio, 6 mi NW of Elota, *Webster 19836* (DAV).—NAYARIT: Mpio. Tepic, Volcán Ceboruco, 10–13 km NW of Jala, *Téllez & Miller 10578* (MICH).—JALISCO: Mpio. Autlán de Navarro, 14–15 mi N of Autlán, *Webster & Breckon 15984* (DAV).—MICHOACÁN: Mpio. Jacona, Jacona, *Moore 140* (UC). —GUANAJUATO: Mpio. Silao, Chichiniequillas, *Galván 3386* (MO).

11.2. *Croton jucundus* Brandege, Zoe 5: 205. 1905.—TYPE: MEXICO. Sinaloa: Mpio. Culiacán, Yerba Buena, 10 Oct 1904, *Brandegee* (holotype: UC!).

The distinctions between *C. jucundus* and *C. subjucundus* are still poorly understood, because available material for examination is inadequate. As remarked by Croizat, *C. jucundus* appears to have larger flowers and seeds than *C. subjucundus*. It may possibly prove more logical to treat these two taxa as allopatric varieties of a single species. The seed size of the specimens from the Islas Tres Marías agrees better with *C. subjucundus*, so assignment of these collections must be regarded as provisional.

REPRESENTATIVE SPECIMENS. NAYARIT: Islas Tres Marías, María Madre, *Howell 10415* (A, CAS), *10496A* (CAS).

- 11.3. *Croton subjucundus*** Croizat, Bull. Torrey Bot. Club 69: 451. 1942.—TYPE: MEXICO. Sonora: Navajoa, *Drouet & Richards 3923* (holotype: A!).

As indicated by Steinmann and Felger (1997), this species is known only from three collections from thorn scrub areas in southern Sonora.

REPRESENTATIVE SPECIMEN. SONORA: Mpio. Huatabampo, arroyo 1 mi N of Bachoco, 27 Dec 1986, *Martin & O'Rourke s.n.* (DAV).

- 11.4. *Croton yecorensis*** V. M. Steinm. & Felger, Novon 8: 207. 1998.—TYPE: MEXICO. Sonora: Mpio. Sahuaripa, 4 km SSW of Mulatos, *Felger & Búrquez 94-574* (holotype: ARIZ; isotype: DAV!).

Although the documented localities of *C. yecorensis* are slightly north of the 28th parallel, it appears quite possible that this species will be encountered to the south. The affinities of *C. yecorensis* are problematic, as remarked by the Steinmann and Felger (1998). Because of various characters, including its bifid rather than quadrifid styles, the species technically does not reside within the boundaries of sect. *Adenophyllum*; however, the glandular-stipitate indumentum and dissected stipules suggest that it fits better here than in any other North American section.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Sahuaripa, 4 km SSW of Mulatos, *Felger & Búrquez 94-578* (DAV); Mpio. Yécora, Rancho La Pinosá, 10 km W of Río Maicoba bridge on MEX-16, *Felger et al. 94-331* (DAV).

- 11.5. *Croton michaelii*** V. M. Steinm., Aliso 19: 184. 2001.—TYPE: MEXICO. Durango: Mpio. Durango, Sierra de Cacaria, 5 km W of El Carmen, *Wilson 96-236* (holotype: RSA; isotype: DAV!).

According to Steinmann (2001), this species is very similar to *C. yecorensis* with which it shares the characteristic narrow leaves and bifid styles. If it were not for this similarity, it would be extremely difficult to assign *C. michaelii* to a section, and its placement in sect. *Adenophyllum* must be regarded as provisional.

REPRESENTATIVE SPECIMENS. DURANGO: Mpio. Durango, Sierra de Cacaria, 5 km W of El Carmen, *Wilson 96-235* (RSA).—AGUASCALIENTES: Mpio. Calvillo, 1 km S of presa El Capulín, *García 2717* (HUAA, fide Steinmann).

- 12. *Croton* section *Medea*** (Klotzsch) Baillon, Étude Euphorb. 368. 1858.—TYPE: *Medea hirta* Klotzsch [= *Croton timandroides* (Didr.) Müll. Arg.].

Croton disjunctus is referred here with considerable diffidence. The presence of petiolar glands in some populations of this species does not agree with the character of sect. *Medea* as circumscribed by Webster (1993); however, the presence of stipitate glands on leaf margins and bracts does not agree with the characters of sect. *Velamea*, where *C. disjunctus* might also be placed. At present, the sectional assignment of *C. disjunctus* must be regarded as doubtful.

- 12.1. *Croton disjunctus*** V. M. Steinm., Aliso 19: 185. 2001.—TYPE: MEXICO. Chihuahua: Mpio. Balleza, "24" [2.4?] road miles W of Durango state line on MEX 45, E of canyon of Río Balleza, *Wilson 96-213* (holotype: RSA; isotype: DAV!).

This recently described species is reported by Steinmann (2001) from the type locality and two stations in Aguascalientes, in oak woodland or scrub at 1800–2200 m. Steinmann notes that the population in Chihuahua has basal foliar glands, whereas the plants in Aguascalientes lack them. He suggests a relationship of *C. disjunctus* with *C. fruticosus* Torr., a species occurring from Texas and Coahuila to eastern Chihuahua; however, *C. disjunctus* shows even closer resemblances to *C. incanus* Kunth, a species occurring from Texas to San Luis Potosí and Querétaro. Except for the rudimentary stipules, the Aguascalientes population of *C. disjunctus* could perhaps be included as a variety of *C. incanus*.

REPRESENTATIVE SPECIMENS. AGUASCALIENTES: Mpio. San José de Gracia, Barranca Serpiens, *García 4390* (RSA, not seen); Mpio. Rincón de Romos, mountains above Presa Calles, *Shreve 9263* (DAV).

13. *Croton* section *Argyroglossum* Baillon, *Adansonia* I, 4: 289. 1864.—TYPE: *Croton argyroglossum* Baillon.

This section is represented in western Mexico by a single species.

13.1. *Croton culiacanensis* Croizat, J. Arnold Arb. 26: 182. 1945.—TYPE: MEXICO. Sinaloa: Culiacán, *Palmer 1507* in 1891 (holotype: A).

So far, all collections of this species have come from Sinaloa. *Croton culiacanensis* is closely related to eastern Mexican *C. watsonii* Standl., which scarcely differs except for its stellate-lepidote (rather than stellate) ovary.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Ymala [Imalá], *Palmer 1446* in 1891 (GH); Mpio. Concordia, ca. 9 km NE of Villa Unión, *Sanders et al. 8696* (DAV); Mpio. Mazatlán, low hills 8 mi N of Mazatlán, *Waterfall 12749* (MICH).

14. *Croton* section *Astraea* (Klotzsch) Baillon, *Étude Euphorb.* 363. 1858.—TYPE: *Croton lobatus* L.

The single local (probably introduced) weedy species of this section, *C. lobatus*, differs strikingly from other western Mexican taxa of *Croton* in its deeply 3-lobed leaves, glabrous receptacle of ♂ flowers, and tetragonal seeds.

14.1. *Croton lobatus* L., Sp. pl. 1005. 1753 (“*C. lobatum*”).—TYPE: [MEXICO.] Veracruz, *Houston s.n.* (BM-Clifford Herbarium).

The illustration in Martyn (*Hist. Pl. Rar.* t. 46. 1737) is probably based on material grown from seed collected by Houston in Veracruz.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Culiacán, 20 Aug 1904, *Brandege* (UC).—NAYARIT: Mpio. Compostela, between Villa Varadero and mouth of Río Ameca, *Cházaro & Montes 6333* (MICH).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Sanders et al. 8660* (DAV).—MICHOCÁN: Mpio. Tepalcatepec, *Cházaro et al. 5601* (MICH).

15. *Croton* section *Drepadenium* (Raf.) Müll. Arg., *Linnaea* 34: 79. 1865.—TYPE: *Croton punctatus* Lam.

The species of this section are very distinct from other Mexican taxa of *Croton* in the apetalous ♂ flower, and eglandular exstipulate leaves with stellate-lepidote

indumentum. Only one species is recorded for tropical western Mexico, but Steinmann and Felger (1997) list two other species in temperate Sonora: *C. texensis* (Klotzsch) Müll. Arg. and *C. wigginsii* L. C. Wheeler.

15.1. *Croton californicus* Müll. Arg. in DC., Prodr. 15(2): 691. 1866. *Hendecandra procumbens* Eschsch., Mém. Acad. Imp. Sci. St. Petersbourg Hist. Acad. 10: 287. 1826, non *Croton procumbens* Jacq., 1760.—TYPE: U.S.A. California, 1824, *Eschscholz s.n.* (holotype: not seen, presumably at LE).

This characteristic strand species is common in Alta and Baja California, and extends down the Mexican mainland to Sinaloa. It is very similar to *Croton punctatus* Jacq., widespread on the coasts of the Atlantic and Gulf of Mexico.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, barrier island opposite Puerto López Mateos, *Johnson 1213* (DAV); Peninsula El Mogote, La Paz, *Johnson 1253* (DAV).—SONORA: Mpio. Huatabampito, Playa Huatabampito, *Sanders et al. 4227* (DAV), *Fishbein et al. 1979* (MO). —SINALOA: Mpio. La Cruz de Elota, 7 mi NW of La Cruz, *Johnson 8056* (DAV); Mpio. Culiacán, Altata, *Gentry 5430* (MO).

PHYLLANTHUS

Within FNG, *Phyllanthus* is represented by 21 species in eight sections. Sectional circumscriptions and arrangement follow Webster (1956–58, 1967). Characters used in the key to sections apply only to taxa occurring in Mexico.

KEY TO THE SECTIONS OF PHYLLANTHUS IN WESTERN MEXICO

1. Lateral stem axes not deciduous, not differentiated from main axes; flowers not confined to specialized branchlets; leaves never reduced to scales.
 2. Herbs or undershrubs; leaves mostly not >3 cm long; pollen grains colpate; seeds smooth or verruculose, >3 mm long.
 3. Leaves spiral; fruiting pedicels not bent or reflexed; ♀ flowers with greenish, foliose sepals and the disk dissected; stems ± terete, never winged.
 1. *Phyllanthus* sect. *Paraphyllanthus*.
 3. Leaves distichous; fruiting pedicels ± reflexed; ♀ flowers with often reddish, not foliose sepals and the disk not dissected; stems terete to compressed or winged.
 2. *Phyllanthus* sect. *Loxopodium*.
 2. Shrubs or trees; leaves mostly >3 cm long; pollen grains areolate; seeds smooth, >3 mm long.
 5. *Phyllanthus* sect. *Elutanthos*.
1. Lateral stem axes deciduous; flowers borne only on lateral leafy branchlets; leaves on main axes distally reduced to scales.
 4. Fruits indehiscent; flowers cauliflorous, borne on leafless axes proximal to leafy branchlets; stamens 4, free.
 3. *Phyllanthus* sect. *Cicca*.
 4. Fruits dehiscent; flowers not cauliflorous, borne on leafy branchlets; stamens 2 or 3, free or connate.
 5. Branchlets all or mostly bipinnatifid; disk of ♂ flowers entire or of 3 segments; stamens 3, filaments connate; shrubs or trees.
 4. *Phyllanthus* sect. *Nothoclema*.
 5. Branchlets pinnatifid; disk of ♂ flowers entire or of 5 or 6 segments; stamens 2 or 3, filaments free to connate; shrubs or herbs.
 6. Shrubs; branchlets fascicled, with only 5–10 leaves; leaf blades hirtellous abaxially on midrib; disk of ♂ flowers annular; stamens 3, free, filaments shorter than anthers.
 6. *Phyllanthus* sect. *Brachycladus*.
 6. Herbs; branchlets not regularly fascicled, with 10 or more leaves; leaf blades glabrous; disk of ♂ flowers dissected; stamens 2–5, free or connate, filaments usually longer than anthers.

7. Stamens 5, filaments free; fruiting pedicels capillary, 3–8 mm long; ♀ flowers often 2 per node; seeds papillose. 7. *Phyllanthus* sect. *Pentandra*.
 7. Stamens 2 or 3, filaments free or connate; fruiting pedicels 1–5 mm long; ♀ flowers solitary; seeds striate, ribbed, or puncticulate. 8. *Phyllanthus* sect. *Phyllanthus*.

1. *Phyllanthus* section *Paraphyllanthus* Müll. Arg., *Linnaea* 32: 3. 1863; DC. Prodr. 15(2): 355. 1866.—LECTOTYPE, designated by Webster, 1956: *Phyllanthus maderaspatensis* L.

There are about ten species of this section in Mexico, of which three are common in Nueva Galicia. A fourth, *P. polygonoides* Nutt. ex Spreng., reaches only Aguascalientes. There has been much confusion about species circumscriptions, and a high percentage of Mexican specimens (other than *P. polygonoides*) have been misidentified.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION PARAPHYLLANTHUS IN WESTERN MEXICO

1. Styles distinctly bifid, 0.3–1.3 mm long; staminal column 0.5–1.5 mm long.
 2. Leaves broadly elliptic to suborbicular; styles at least 1 mm long; stipules less than 1 mm long. 1.1. *P. gypsicola*.
 2. Leaves obovate; styles less than 1 mm long; stipules usually at least 1 mm long.
 3. Herb not over 0.5 m tall, stems clustered at base; stipules distinctly auriculate at base; seeds not over 1.5 mm long. 1.3. *P. polygonoides*.
 3. Shrubs to 1–2 m tall; stipules not distinctly auriculate at base; seeds 1.7–2.4 mm long.
 4. Branches smooth; seeds 1.9–2.4 mm long. 1.2a. *P. peninsularis* subsp. *peninsularis*.
 4. Branches papillate; seeds 1.7–2 mm long. 1.2b. *P. peninsularis* subsp. *novogalicianus*.
1. Styles undivided, 1–1.5 mm long; staminal column 1.5–2 mm long. 1.4. *P. galeottianus*.

1.1. *Phyllanthus gypsicola* McVaugh, *Brittonia* 13: 194. 1961.—TYPE: MEXICO. Colima: 11 mi SSW of Colima, in deciduous woodland with *Bursera*, *Amphypterygium*, 400–500 m, *McVaugh & Koelz 1573* (holotype: MICH!; isotype: DAV!).

Although most collected in Colima, this species also occurs in southern Baja California, where it has been confused (as noted below) with *P. peninsularis*. However, in leaf shape and dimensions of flowers, it is more similar to *P. galeottianus* and appears to be a lower-elevation, more xeric vicariant of that species.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, 14 mi by road E of Cabo San Lucas, 30 m, *Hastings & Turner 64-345* (DS); Cabo San Lucas, *Brandeggee 540* (UC).—JALISCO: Mpio. La Huerta, Cerro Maderas, 200 m, *Lott 1823* (TEX).—COLIMA: Mpio. Comala, 19–20 km NW of Colima, 1400 m, *Santana et al. 5269* (WIS); Mpio. Colima: 15 mi SSW of Colima, *McVaugh 15542* (DAV, MICH).

1.2. *Phyllanthus peninsularis* Brandeggee, *Erythea* 7: 8. 1899.—TYPE: MEXICO. Baja California Sur: San José del Cabo, *Anthony 364* (lectotype, here designated: UC!; isoelectotype: MO!).

Brandeggee cited both San José del Cabo and Sierra la Laguna, and indicated his number 539. Unfortunately, *Brandeggee 539* could not be located; there is a Brandeggee collection labelled number 15 from Sierra La Laguna that does represent

P. peninsularis. Another collection at Berkeley (UC) is *Brandeggee 540*, which represents the Baja California form of *P. gypsicola* McVaugh. In order to preserve the name *Phyllanthus peninsularis* in the sense it has been used by most botanists, it is preferable to select as lectotype *Anthony 364*, also from San José del Cabo, and the only other collection number cited in the protologue.

A number of collections of *P. peninsularis* from the mainland (Nayarit and Jalisco) and some from Baja California have been mistakenly identified as *P. galeottianus* or *P. subcuneatus* Greenm. All of the Nueva Galician specimens differ from *P. galeottianus* in having narrower leaf blades, distinctly bifid styles, and smaller ♂ flowers (sepals less than 2 mm long, staminal column <1.5 mm long). Also, they differ in their larger, more pointed leaf blades and bifid styles from *P. subcuneatus*, which seems to be confined to the Sierra Madre Oriental.

Phyllanthus peninsularis displays a gap in geographic variation between the populations in Baja California and on the mainland. It is therefore necessary to recognize two subspecies, one of which is here described.

1.2a. *Phyllanthus peninsularis* subsp. *peninsularis*.

Twigs smooth; sepals of ♂ flowers (1.5–) 1.8–2.5 mm long; seeds 2.1–2.4 mm long.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, Isla Espiritu Santo, *Wiggins 16121* (MICH); Sierra La Laguna, *Brandeggee 15* (UC), *Moran 7430* (DS, US); La Burrera, 27 km E of Todos Santos, *Tenorio et al. 10516* (MEXU); Saucito, 1891, *Brandeggee s.n.* (UC, US); San José del Cabo, *Brandeggee 540* (UC), *Dawson 1178* (MICH).

1.2b. *Phyllanthus peninsularis* subsp. *novogalicianus* G. L. Webster, subsp. nov.—

TYPE: MEXICO. Jalisco: Mpio. Talpa de Allende, 11–12 mi S of Talpa, 1200–1700 m, in subtropical mixed forest with *Carpinus*, *Magnolia*, *Quercus*, and *Matudaea*, *McVaugh 20390* (holotype: MICH!). Fig. 2.

Phyllanthus peninsularis subsp. *novogalicianus* ab subsp. *peninsulari* differt ramulis papillois, floribus ♂ minoribus, seminibus 1.7–2 mm longis.

It must be noted that specimens from Sinaloa (*H. S. Gentry 11446, 24330*, MICH) and Nayarit (*Palmer 1887*, MICH) are atypical in lacking the papillate branches and appear transitional to *P. gypsicola*.

REPRESENTATIVE SPECIMENS. NAYARIT: Tepic, *Palmer 1887* (US); Mpio. Tepic: 13 km by road W of junction of MEX-15 and Nay-66, 1225 m, *Steinmann & Varela 1076* (DAV).—JALISCO: Mpio. Cuautitlán, Sierra de Manantlán, 30–35 km SE of Autlán, *McVaugh 23228* (MICH); 1–2.5 km SW of Rincón de Manantlán, *Judziewicz & Guzmán 5062* (MICH).

1.3. *Phyllanthus polygonoides* Nutt. ex Spreng., Syst. veg. 3: 23. 1826. *Maschalanthus polygonoides* (Nutt. ex Spreng.) Nutt., Trans. Amer. Philos. Soc., ser. 2, 5: 175. 1837.—TYPE: U.S.A. “Arkansas,” *Nuttall s.n.* (lectotype, here designated: NY!).

This species, primarily of the Chihuahua Desert and Texas, barely enters tropical western Mexico in Aguascalientes and southern Sonora; collections from Municipios Bacerac and Cucurpe, Sonora, are cited by Steinmann and Felger (1997).

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, Cañón Saucito, *Gentry 689* (F).—AGUASCALIENTES: 6 km E of Tepezalá, *Rzedowski & McVaugh 1230* (MICH).

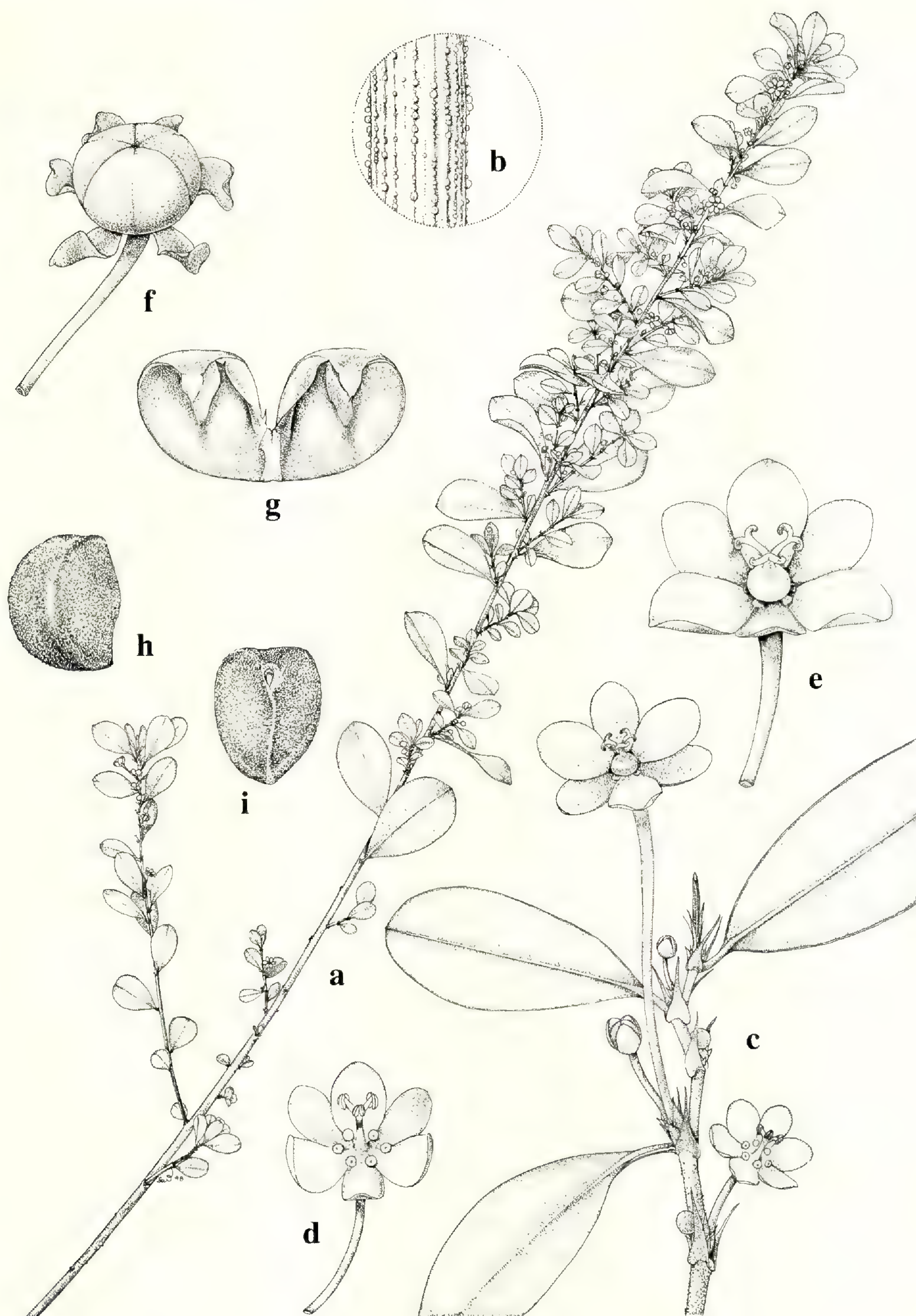


FIG. 2. *Phyllanthus peninsularis* Brandegees subsp. *novogalicianus*. A. Flowering branch, $\times 0.75$. B. Stem with papillae, $\times 10$. C. Tip of branch with pistillate flower above and staminate flower below, $\times 3.5$. D. Staminate flower, $\times 7.5$. E. Pistillate flower, $\times 7.5$. F. Capsule, $\times 6$. G. Two cocci of dehiscent capsule, $\times 9$. H. Seed, lateral view, $\times 10$. I. Seed, adaxial view, $\times 10$.

1.4. *Phyllanthus galeottianus* Baill., *Adansonia* I, 1: 32. 1860.—TYPE: MEXICO. Michoacán: Morelia, *Galeotti* 7215 (lectotype, here designated: P!).

Phyllanthus americanus Sessé & Moc., Pl. nov. hisp. 159. 1890.—TYPE: MEXICO. Guerrero: Mazatlán, *Sessé & Moçiño s.n.* (lectotype, here designated: G-Del; isotype: MA!). [The MA sheet is numbered 4561; a painting (Ic. Fl. Mex. 298) is at G.]

As pointed out before (Webster 1966), Baillon cited the specimen at G-Delessert at a time before the “*Icones Flora Mexicanae*” were rediscovered. McVaugh (2000) enumerates in detail the specimens and drawings associated with the names *Phyllanthus americanus* and *P. galeottianus*, but does not typify either name.

The name *P. galeottianus* has been mistakenly applied to the majority of specimens of sect. *Paraphyllanthus* in Mexico. In the strict sense, the species includes only upland plants (> 1000 m elevation) in the central and western Mexican highlands (Guanajuato and Jalisco to Guerrero and México) with larger flowers and unlobed styles. For clarification, additional specimens are cited from states in eastern Mexico.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Guadalajara: barrancas, *Pringle* 4443 (MICH, MO); Mpio. Tuxcacuesco, 5–6 km ENE of Zenzontla, 1100 m, *Santana & Benz* 5922 (WIS).—MÉXICO: Temascaltepec, *Hinton* 4497 (LL).—GUERRERO: Mpio. Coyuca, Mina, Carrizeras, *Hinton* 10482 (MICH).—OAXACA: Mpio. San Juan Mixtepec, Río San Lucas, 1780 m, *Reyes Santiago* 389 (MEXU).—CHIAPAS: Mpio. Jitotol, 1450 m, *Breedlove* 26400 (CAS).

2. *Phyllanthus* section *Loxopodium* G. L. Webster, *Contr. Gray Herb.* 176: 46. 1955.—TYPE: *Phyllanthus caroliniensis* Walt.

The widespread American species *P. caroliniensis* has not been recorded from western Mexico; we have only the following two species in this section.

2.1. *Phyllanthus evanescens* Brandegees, *Zoe* 5: 207. 1905.—TYPE: MEXICO. Sinaloa: Culiacán, *Brandegee s.n.* (holotype: UC!).

Phyllanthus pudens L. C. Wheeler, *Contr. Gray Herb.* 127: 50. 1939. *Phyllanthus avicularia* Small, *Bull. Torrey Bot. Club* 27: 278. 1900, non *Phyllanthus avicularis* Müll. Arg., 1863.—TYPE: U.S.A. Texas: Austin Co., “Columbia” [Columbus], *B. F. Bush* 263 (holotype: NY).

Stems scabridulous or hispidulous; filaments free; fruiting pedicel 1.2–1.8 (–2.2) mm long; styles bifid, not dilated; capsule 2.8–3.2 mm in diameter, seeds 1.3–1.6 mm long.

The characters used by Texas authors to recognize populations from Tamaulipas and southern Texas as *P. pudens* appear indistinguishable from those used to delimit populations from western Mexico as *P. evanescens*. *Phyllanthus evanescens*, a species characteristic of seasonally inundated grassy habitats, is disjunct to Nicaragua, and may be expected elsewhere in northern Central America.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Lodiago, 55 km NE of Culiacán, *Palmer* 1590 (US).—JALISCO: Mpio. Jocotepec, Ejido Zapotitán de Hidalgo, *Machuca* 3417 (WIS); Mpio. La Huerta, Est. Biol. Chamela, *Lott & Ayala* 2629, *McVaugh* 25197 (MICH). —GUANAJUATO: Mpio. Jaral del Progreso, Santiago Capitiro, *Rzedowski* 39366 (DAV). Also reported from Sonora by Steinmann and Felger (1997: 62).

- 2.2. *Phyllanthus brandegei*** Millsp., Proc. California Acad. Sci., ser. 2, 2: 218. 1889.—
TYPE: MEXICO. Baja California Sur: Comondú, 17 Feb 1889, *T. S. Brandegee 19* (holotype: UC!).

Stems smooth; filaments connate; fruiting pedicel 1.8–1.9 mm long; styles dilated; capsule 3.5–4 mm in diameter, seeds 1.8–1.9 mm long.

Phyllanthus brandegei is known only from the type collection and possibly is extinct. A specimen from Sonora (Mpio. Huatabampo, 2 km NE of Las Aguilas, *Sanders et al. 13562*, UCR) appears somewhat intermediate between *P. evanescens* and *P. brandegei*; it has the smooth stems, dilated styles, and larger seeds of the latter, but free filaments and shorter fruiting pedicels of the former.

- 3. *Phyllanthus* section *Cicca*** (L.) Müll. Arg., Linnaea 32: 50. 1863. *Cicca* L., Mant. pl. 124. 1767.—TYPE: *Cicca acida* L. [= *Phyllanthus acidus* (L.) Skeels].

Since my original consideration of subg. *Cicca* (Webster 1957), the status of sect. *Aporosella*, to which our only local species belongs, has been reevaluated. In 1957, sect. *Aporosella* was maintained as distinct from sect. *Cicca* because of its dioeciousness and lack of a floral disk. Yet, vegetatively the two groups are similar, and both have drupaceous fruits produced ramiflorously. It seems appropriate to recognize this similarity by delimiting sect. *Cicca* as comprising two subsections, the monotypic subsect. *Cicca* and subsect. *Aporosella*.

- Phyllanthus* subsection *Aporosella*** (Chodat) G. L. Webster, stat. nov. *Aporosella* Chodat, Bull. Herb. Boiss., sér. 2, 5: 488. 1905. *Phyllanthus* sect. *Aporosella* (Chodat) G. L. Webster, J. Arnold Arb. 38: 72. 1957.—TYPE: *Aporosella hassleriana* Chodat [= *Phyllanthus chacoensis* Morong].

The subsection includes only two species, the South American *P. chacoensis* and our local species, *P. elsiae*.

- 3.1. *Phyllanthus elsiae*** Urb., Repert. Spec. Nov. Regni Veg. 15: 405. 1919.—TYPE: TRINIDAD AND TOBAGO. Tobago: Auchenskeoch Beach, *Broadway 4789* (lectotype, designated by Webster, 1957: US!).

In an earlier review (J. Arnold Arb. 38: 75. 1957), *P. elsiae* was reported from western Mexico only from Nayarit. Since then, it has been found at a number of different localities, most often in coastal woods adjacent to mangroves. It is closely related to *P. chacoensis* Morong of the Pantanal region of South America.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tuxpan, Mexcaltitán, *Mexia 1005* (US).—JALISCO: Mpio. La Huerta, Cuixmala, *Castillo 5149, 5235* (DAV), *Lott et al. 3472* (MO).—COLIMA: Mpio. Manzanillo, Laguna Cuyutlán, *McVaugh 15628* (MICH).—MICHOCÁN: Mpio. Coahuayana, mouth of Río Coahuayana, *Turner 1999* (TEX).

- 4. *Phyllanthus* section *Nothoclema*** G. L. Webster, Contr. Gray Herb. 176: 56. 1955.—TYPE: *Phyllanthus acuminatus* Vahl.

Only three species of this American section of ten species, characterized by its mostly bipinnatifid branchlets, have been recorded from western Mexico.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION NOTHOCLEMA IN WESTERN MEXICO

1. Leaf blades scabrous adaxially, acute or acuminate; anthers acute; styles $\pm$ dilated; branchlets mostly with 10–20 lateral axes. 4.1. *P. acuminatus*.
1. Leaf blades smooth adaxially, acute to rounded; anthers emarginate or obtuse; styles slender; branchlets with 0–15 lateral axes.
 2. Branchlets with 10–15 lateral axes; pedicels of δ flowers not over 5 mm long; sepals 1 mm long. 4.2. *P. micrandrus*.
 2. Branchlets with 1–4 (–8) lateral axes (sometimes simple); pedicels of δ flowers 5–15 mm long; sepals 1.5 mm long or more. 4.3. *P. mocinianus*.

4.1. *Phyllanthus acuminatus* Vahl, Symb. bot. 2: 95. 1791.—TYPE: TRINIDAD. *Ryan s.n.* (holotype: C!).

?*Phyllanthus sessei* Briquet, Ann. Conserv. Jard. Bot. Genève 4: 224. 1900.—TYPE: MEXICO. *Sessé & Mociño* (G-Del, holotype).

This widespread species extends from Mexico to Argentina and Brazil, but is very uncommon in western Mexico, where it occurs in disturbed woodlands below 1000 m. Synonymy and a map of the Caribbean distribution have been given earlier (J. Arnold Arb. 38: 365–367. 1957).

The citation of *Phyllanthus sessei* Briq. as a synonym of *P. acuminatus* is made with some doubt, because of floral differences pointed out by Webster (1966) (especially Briquet's description of the calyx of the male flowers as ca. 1.5 mm long in *P. sessei*). McVaugh (2000) cites other specimens and drawings from the Sessé and Mociño collections, and also suggests that *P. sessei* is probably a synonym of *P. acuminatus*. Re-examination of this material is desirable to determine if Briquet's description is erroneous, or if *P. sessei* is yet another endemic species in Nueva Galicia.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, La Burrera, 27 km E of Todos Santos, *Tenorio et al.* 10506 (DAV).—NAYARIT: Mpio. Tuxpan, camino a est. microondas Peñitas, *Téllez* 12805 (MICH); Mpio. Compostela, 7–9 km W of Mazatlán, *Téllez & Davila* 9070 (MEXU).—JALISCO: Mpio. La Huerta, 15 km NW of Juan Gil Preciado, *Santana & Cervantes* 499 (WIS).—COLIMA: Mpio. Manzanillo, 13 mi N of Santiago, *McVaugh* 15839 (MICH, US).—MICHOACÁN: Mpio. Aquila, Aquila, *Hinton* 15065, 16109 (MICH, US).

4.2. *Phyllanthus micrandrus* Müll. Arg., Linnaea 32: 27. 1863; DC., Prodr. 15(2): 383. 1866.—Type: VENEZUELA. Aragua: Colonia Tovar, *Fendler* 1195 (lectotype, here designated: G!; isoelectotypes: K! MICH! MO!).

Phyllanthus micrandrus occurs in deciduous and oak woodlands mainly from 1000–1500 m. It is similar to *P. mocinianus* in aspect and sometimes mistaken for it; however, it is readily separable by its more highly ramified branchlets and much smaller flowers. The disjunction in the range of the Mexican populations of *P. micrandrus* from those in Costa Rica and South America is remarkable, but is paralleled by the distribution of *P. botryanthus* of sect. *Elutanthos*. It is possible that further study of the Mexican plants may show them to be a distinct subspecies, but the few specimens available do not show any clear morphological differences.

REPRESENTATIVE SPECIMENS. NAYARIT: Islas Tres Marías, María Madre, *Howell* 10452 (A, CAS); Mpio. Compostela, 4 mi N of San Juan Caxtle, *Norris & Taranto* 13668 (MICH).—JALISCO: Mpio. Guadalajara, Barranca de Huentitán el Alto, *Cházaro et al.* 6260 (MO), *Flores Macias & Reynoso* 1106 (WIS); Mpio. Autlán de Navarro, 9–10 mi SW of Autlán, *McVaugh* 14201 (MICH).

4.3. *Phyllanthus mocinianus* Baillon, *Adansonia* I, 1: 35. 1860.—TYPE: MEXICO. *Sessé & Mociño s.n.* (lectotype, designated by McVaugh, 2000: G-Del!).

This is by far the commonest representative of sect. *Nothoclema* in both western and eastern Mexico and extends to Belize and Guatemala. In Nueva Galicia, it is found in a variety of habitats, from lowland deciduous woodlands or scrub to mesic woodlands in upland (to 1100 m) barrancas. It is morphologically similar to *P. anisobus* Müll. Arg. of Costa Rica to Ecuador, and was circumscribed to include that species by Burger and Huft (1995). However, *P. mocinianus* may be separated by its androecium with shorter staminal column and horizontally dehiscent (not deflexed) anthers, as well as by its shorter styles.

REPRESENTATIVE SPECIMENS. CHIHUAHUA: Batopilas, *Gentry 2619* (A, MO).—SINALOA: Sierra Surotato, Quebrada de Mansana, *Gentry 6534* (GH, MO).—NAYARIT: Islas Tres Marías, María Madre, *Ferris 5569* (A, DS); Mpio. Ruiz, 2–3 km E of El Venado, *Breedlove & Almeda 45209* (CAS).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott & Philips 3671* (DAV).—COLIMA: Cd. Colima, *Jones 23* (DS).—MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 13882* (GH, TEX).—MÉXICO: Temascaltepec, Mpio. Tejupilco, Nanchititla, *Hinton 5330* (GH, MO, TEX).

5. *Phyllanthus* section *Elutanthos* Croizat, J. Wash. Acad. Sci. 33: 12. 1943.—TYPE: *Phyllanthus glaucescens* Kunth [= *P. grandifolius* L.].

This neotropical section includes three species in western Mexico and several others in eastern Mexico, including the type species, *P. grandifolius* L.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION ELUTANTHOS IN WESTERN MEXICO

1. Stamens 3, anthers borne on filaments; seeds 2–8 mm long.
 2. Styles distinctly bifid; sepals >2 mm long; stamens free or nearly so; seeds ca. 8 mm long.
 - 5.1. *P. coalcomanensis*.
 2. Styles entire or emarginate; sepals <2 mm long; stamens connate, forming a column; seeds 2–2.5 mm long.
 - 5.2. *P. botryanthus*.
1. Stamens 2, anthers sessile (the two modified and seemingly a single anther); seeds 6.5–8 mm long.
 - 5.3. *P. tequilensis*.

5.1. *Phyllanthus coalcomanensis* Croizat, J. Wash. Acad. Sci. 33: 13. 1945.—TYPE: MEXICO. Michoacán: Coalcomán, *Hinton 15857* (holotype: US!; isotype: MICH!).

Phyllanthus coalcomanensis grows in perhaps somewhat less xeric lowland (up to 500 m) forests than *P. botryanthus*. It appears to be rather uncommon, with a few collections known from Nayarit, Colima, and Michoacán, but so far none from Jalisco. It is possible that this species occurs further east to Chiapas and even Nicaragua, but the available collections are so incomplete that they can be only tentatively assigned to *P. coalcomanensis*.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tuxpan Peñitas, estación microondas Peñitas, *Téllez 12674* (MO); Mpio. San Blas, Ensenada de Matanchén, *Ferris 5437* (DS, US).—COLIMA: Mpio. Manzanillo, 8 mi WNW of Santiago, *McVaugh 15785* (MICH, US).—MICHOACÁN: Mpio. Aquila, wooded hill and barranca, *Hinton 15859, 15967* (MICH, US).

5.2. *Phyllanthus botryanthus* Müll. Arg. in DC., Prodr. 15(2): 323. 1866.—TYPE: COLOMBIA. Bolívar: Cartagena, *Triana 3664* (lectotype, designated by Webster, 1958: P!; isotypes: K! W!).

This species, which is common in lowland tropical woodlands in Jalisco (but not elsewhere in Nueva Galicia), has not been previously reported from North America. The Mexican populations are disjunct from xeric areas in coastal northern South America (Colombia to Venezuela and the Dutch offshore islands, Aruba to Bonaire); no intermediate populations are known in Central America. This appears to be an unusual geographic pattern in *Phyllanthus*, although it may represent an extreme of a pattern shown by other members of the Euphorbiaceae (e.g., *Croton morifolius*), which extend from Mexico into Nicaragua, with a gap only in Costa Rica and Panama.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Tomatlán, 46 km N of Chamela, *Guadalupe Ayala* 160 (MICH); Mpio. La Huerta, 2.5 km W of Quémaro, *Lott* 1716 (MICH); Rancho Cuixmala, *Castillo et al.* 52320 (MO), *Lott et al.* 3705 (MO).

5.3. *Phyllanthus tequilensis* B. L. Rob. & Greenm., Proc. Amer. Acad. Arts 29: 392. 1894.—TYPE: MEXICO. Jalisco: Tequila, *Pringle* 5490 (holotype: GH!; isotypes: MO! UC!).

Phyllanthus micromalus McVaugh, Brittonia 13: 198. 1961.—TYPE: MEXICO. Nayarit: 10 mi SE of Tepic, *McVaugh* 16569 (holotype: MICH!; isotype: DAV!).

This species is common especially in dry woodlands (oak and tropical deciduous) from 300–1500 m in Jalisco, Nayarit, and the Tres Marías Islands, where it has often been misidentified as *P. adenodiscus* Müll. Arg. or *P. grandifolius* L. It is readily distinguished by its inflated capsules, 3–4 cm broad, and by its unique androecium of two stamens modified so that there appears to be a single anther dehiscing upwardly. East of the Nueva Galicia region, specimens have been seen that may also referable to *P. tequilensis*, but with smaller fruits and seeds (e.g., *Ramírez Cantú s.n.* from Isla Roqueta, Acapulco, Gro., MEXU). A single collection from Chamela, Jalisco (*Lott et al.* 1564, MICH), where the species is not common, has capsules only 1.5 cm in diameter, and thus resembles the Guerrero collection. These small-fruited plants appear to represent *P. oaxacanus* Brandegee, described from “San Geronimo” [San Jerónimo], Oaxaca (*Purpus* 7154, UC, holotype!; MO, isotype). Flowering specimens from southern Oaxaca, 75 miles by road SE of Oaxaca (*Croat* 39957, 39958, MO) have flowers typical for *P. tequilensis*. It is conceivable that *P. oaxacanus* could be retained as a small-fruited subspecies of *P. tequilensis*, of which the Chamela collection is the northernmost locality; however, sampling of fruiting specimens of Mexican collections of sect. *Elutanthos* is so inadequate that the problem cannot be resolved at this time.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Baila, Santa María, *González Ortega* 6708 (CAS).—DURANGO: Mpio. Mezquital, Huasemote, *Rose* 2315 (US).—ZACATECAS: Mpio. Juchipila, 5 km SE of Pueblo Nuevo, *Rzedowski* 18264 (MICH).—NAYARIT: Islas Tres Marías, María Madre, *Ferris* 5697 (DS, US); Mpio. Compostela, 5 mi NW of Las Piedras, *Webster & Lynch* 17124 (DAV).—JALISCO: Mpio. Juchitlán, Los Carrales a Los Guajes, *Machuca & Cházaro* 6579 (DAV, MO).—MICHOCÁN: Mpio. Jungapeo, abajo de Agua Blanca, *Martínez* 376 (DAV).

6. *Phyllanthus* section *Brachycladus* G. L. Webster, sect. nov.—TYPE: *Phyllanthus rupestris* Kunth in H. B. K.

Frutices monoici; ramulis deciduis, floriferis, fasciculatis, non ramosis, foliis paucis (5–10); sepalis ♂ 6; discus integer; stamina 3, filamentis liberis connatisve; antherae muticae; pollinis grana globosa areolata; sepalis ♀ 6; discus patelliformis; ovarium triloculare; stylis liberis, bifidis; fructus capsularis; semina laevia.

Monoecious shrubs with phyllanthoid branching; branchlets fasciculate, unramified, with few leaves (5–10); ♂ flowers with 6 sepals, an annular disk, and 3 stamens with the filaments free or connate and the anthers muticous, the pollen grains globose, areolate, areoles polybrochate; ♀ flowers with 6 sepals, a patelliform disk, a 3-locular ovary, and free and bifid styles with slender branches; fruit capsular, seeds smooth.

Section *Brachycladus* is primarily a South American group, with most species confined to the Amazon Basin. At least six South American species can be referred here, including *P. adianthoides* Klotzsch, *P. atabapoensis* Jabl., *P. paezensis* Jabl., *P. rupestris* Kunth, and two undescribed species. All of the species seem to be characteristic of riparian habitats in areas of tropical evergreen forest. The affinities of sect. *Brachycladus* are clearly with taxa of subg. *Xylophylla*, as shown by the characteristic areolate pollen grains, but the section appears to be isolated by its androecium of discrete stamens, annular disk in the ♂ flowers, and short branchlets with few leaves.

6.1. *Phyllanthus mickelii* McVaugh, Brittonia 13: 196. 1961.—TYPE: MEXICO. Colima: Mpio. Manzanillo, 8 mi WNW of Santiago, *McVaugh 15763* (holotype: MICH!).

Phyllanthus mickelii, the only representative of sect. *Brachycladus* in North America, is highly disjunct from the other species; also, it is ecologically divergent in its deciduous woodland habitat (especially in woods of *Piranhea*). It would appear to be most closely related to *P. rupestris*, which is widespread from Amazonian Colombia to Brazil. The resemblance between the two species is very close, although the leaves of *P. rupestris* differ in their more prominulous venation. Because of the scarce material of *P. mickelii* available for study, a final decision on its status as a distinct species cannot yet be made.

ADDITIONAL SPECIMENS EXAMINED. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Lott 2592* (MICH), *3820* (MO), *3897* (DAV), *Pérez 1760* (DAV, MEXU).

7. *Phyllanthus* section *Pentandra* G. L. Webster, J. Arnold Arb. 48: 333. 1967.—TYPE: *Phyllanthus pentandrus* Schumach. & Thonn.

This African-Malagasian section of shrubs and herbs is represented in the New World only by the following introduced herbaceous species.

7.1. *Phyllanthus tenellus* Roxb., Flora Indica, ed. 2, 3: 668. 1832.—TYPE: INDIA. West Bengal: Calcutta Botanical Gardens, *Wallich 7892 ex p.* (holotype: K!).

The single collection cited below represents a new record for Mexico; the species has previously been recorded from the New World only in the eastern U.S.A., the West Indies, and South America.

SPECIMEN EXAMINED. NAYARIT: Mpio. Tepic, ca. 15 km W of Tepic, *Steinmann & Varela 1079* (DAV).

8. *Phyllanthus* section *Phyllanthus*.

Five species of sect. *Phyllanthus*, all herbaceous, have been recorded from western Mexico.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION PHYLLANTHUS IN WESTERN MEXICO

1. Cymules unisexual, ♂ flowers at proximal nodes of branchlet.
 2. Leaf blades distinctly inequilateral at base; seeds verruculose, 1.5–1.8 mm long. 8.1. *P. niruri*.
 2. Leaf blades not distinctly inequilateral at base; seeds striate or finely ribbed, <1.5 mm long.
 3. Stamens 3; sepals of ♂ flowers 5 or 6.
 4. Stems often with aerenchyma at base; leaf blade margins often reddish; disk of ♀ flowers 5-angled; filaments completely connate. 8.2. *P. stipulatus*.
 4. Stems without aerenchyma, leaf blade margins never reddish; disk of ♀ flowers asymmetrically 3-lobed; filaments connate in proximal half. 8.3. *P. caribaeus*.
 3. Stamens 2; sepals of ♂ flowers 4. 8.4. *P. standleyi*.
1. Cymules bisexual (at least at distal nodes of branchlet).
 5. Sepals 5, distinctly acute; disk of ♀ flowers 5-lobed; distal cymules each with 1 ♂ and 1 ♀ flower; seeds finely ribbed on back, 0.9–1 mm long; leaf blades oblong. 8.5. *P. amarus*.
 5. Sepals 6, obtuse or subacute; disk of ♀ flowers 6-lobed; distal cymules each with 1 ♀ and 1–3 ♂ flowers; seeds striate on back, 1.2–1.5 mm long; leaf blades elliptic. 8.6. *P. hexadactylus*.

8.1. *Phyllanthus niruri* L., Sp. pl. 981. 1753.—TYPE: specimen in the Hortus Clifortianus Herbarium (holotype: BM!).

This widespread American species, characteristically occurring in upland montane evergreen forests (>1000 m), has also been found near sea level in deciduous forest and woodlands in Sinaloa. It has been confused with several neotropical and paleotropical species, but has not been introduced into the Old World. It is rather variable, and a number of segregates have been proposed (Webster 1970).

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, road to Presa Adolfo López Mateos, *Steinmann & Varela 1155* (DAV); Mpio. Mazatlán, 7 mi SE of Mazatlán, *Webster & Breckon 15636* (DAV).—NAYARIT: Mpio. Tepic, mountains 9.5 mi W of Tepic, *McVaugh 18945* (MICH).—JALISCO: Mpio. Talpa de Allende, 11–12 mi S of Talpa, *McVaugh 20407* (MICH).

8.2. *Phyllanthus stipulatus* (Raf.) Webster, Contr. Gray Herb. 176: 53. 1955. *Moeroris stipulata* Raf., Sylva tellur. 91. 1838.—TYPE: JAMAICA. *Swartz s.n.* (lectotype, designated by Webster, 1955: S!).

This widespread species of semi-aquatic or aquatic habitats is recorded in western Mexico only from the following collection.

SPECIMEN EXAMINED. NAYARIT: Mpio. Compostela, wet meadow 4–5 mi N of Compostela, *McVaugh 19328* (MICH).

8.3. *Phyllanthus caribaeus* Urb., Symb. antill. 5: 382. 1908.—TYPE: TRINIDAD AND TOBAGO. Tobago: *Eggers 5733* (lectotype, designated by Webster, 1957: F!; isotype: NY!).

This Doppelgänger of *P. stipulatus* apparently replaces that species in western Mexico. Only one character, the unusual asymmetrical disk in the ♀ flower, is invariably diagnostic for distinguishing *P. caribaeus*. It seems to be ecologically separated from *P. stipulatus* by occurring in moist forest rather than in aquatic habitats.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tepic, 9.5 mi W of Tepic, *McVaugh 18945* (MICH).—JALISCO: Mpio. Tecalitlán, between Tecalitlán and San Isidro, *McVaugh 16176* (DAV, MICH).

8.4. *Phyllanthus standleyi* McVaugh, Brittonia 13: 199. 1961. *Phyllanthus perpusillus* Standl., Amer. Midl. Nat. 36: 178. 1948, non *Phyllanthus perpusillus* Baillon, 1866.—TYPE: MEXICO. Michoacán: 2 mi W of Uruapan, *Leavenworth & Hoogstraal 1282* (holotype: F).

This diminutive species, found in pine or oak forests or deciduous woodlands (300–1200 m), in most instances is readily distinguishable from *P. caribaeus* and *P. stipulatus* by its ♂ flowers with a 4-merous perianth and an androecium of two stamens.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Santa María del Oro, oak woods 25 km by road SE of Tepic, *Webster & Breckon 15683* (DAV).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott et al. 2891* (DAV, MICH).—COLIMA: Mpio. Colima, 11–12 mi SSW of Colima, *McVaugh 16038* (MICH), *Webster & Breckon 16129* (DAV).

8.5. *Phyllanthus amarus* Schumach. & Thonn., Beskr. guin. pl. 421. 1827.—TYPE: GHANA. “Guinea,” *Schumacher & Thonning* (holotype: C!).

Undoubtedly the commonest, weediest, and most widespread of all species of *Phyllanthus*, *P. amarus* has a pantropical distribution. Although there are few collections from Nueva Galicia, this weedy species will surely be encountered in other lowland areas.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott et al. 3565* (DAV); Mpio. Cihuatlán, 9 mi N of W end of Bahía Navidad, *McVaugh 20917* (MICH).—COLIMA: Colima, *Orcutt 6925* (DS); Manzanillo, *Palmer 925* in 1890 (US).

8.6. *Phyllanthus hexadactylus* McVaugh, Brittonia 13: 195. 1961.—TYPE: MEXICO. Michoacán: Mpio. Apatzingán, 4 mi W of Apatzingán, *McVaugh 17945* (holotype: MICH!; isotype: DAV!).

This diminutive species has a curious disjunct distribution; it has been recorded only from lowland deciduous forest areas in Sonora and Michoacán. It appears similar to *P. caribaeus*, but is rather easily distinguished by its wing-angled branchlets, elliptic to obovate leaves, and hexamerous perianth.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, near Arroyo Potrero, 7 km ESE of Alamos, *Steinmann et al. 94-60* (DAV).—MICHOCÁN: Mpio. La Huacana, 29.8 km N of Descansadero, *Steinmann & Varela 1116* (DAV).

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NEW RECORDS OF BENTHIC MARINE ALGAE FROM THE SULTANATE OF OMAN, NORTHERN ARABIAN SEA. III.

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ABSTRACT. Seventeen taxa of benthic marine algae are reported for the first time from the Sultanate of Oman. These include 12 taxa of Rhodophyta, 3 taxa of Ochrophyta (Phaeophyceae), and 2 taxa of Chlorophyta. The following taxa had not been previously known to occur in the Indian Ocean: *Gelidiella ligulata* E. Y. Dawson, *Chrysomenia grandis* Okamura, *Nitophyllum adhaerens* M. J. Wynne, and *Pseudobryopsis myura* (J. Agardh) Berthold.

INTRODUCTION

Further investigations of collections of benthic marine algae from the Sultanate of Oman have resulted in the recognition of additional new records for this region of the northern Arabian Sea. Extensive collecting in the mid-1980's carried out by personnel of the Tropical Marine Research Unit, University of York, U.K., produced a preliminary list of species (Barratt et al. 1984), which was later included in the Indian Ocean catalogue of benthic marine algae by Silva et al. (1996). More recently, papers from my lab and in collaboration with Barry P. Jupp led to the publication of a number of new records for Oman (Wynne & Jupp 1998; Wynne 1999b, 2000, in press; Wynne & Leliaert 2001) and some new taxa (Wynne 1998b, 1999a, 2001). A complex picture of floristic affinities is emerging, with a mixture of typical widely occurring tropical species alongside warm- and cool-temperate elements, including the kelp *Ecklonia radiata* (C. Agardh) J. Agardh. A number of new records for the Indian Ocean have been reported (Wynne 2000) of species previously known only from Japan and elsewhere in Asia. Several species previously known from southern Africa also occur on the Omani coast (Wynne 1999b). The most significant factor is the summertime monsoon with its associated upwelling bringing relatively cooler, nutrient-rich water and much turbulence.

The following list of new records is based on the collections made by personnel of the Tropical Marine Research Unit (=TMRU) of the University of York, U.K., and by my own fieldwork conducted in early 1997. Also included are collections made by Dr. Jose Stirn, formerly of Sultan Qaboos University, Muscat, and presently at the National Institute of Biology, University of Ljubljana, Portoroz, Slovenia. Personnel of the Hunting Technical Services of York, U.K., including Emma Dodsworth, Glenn Richards, and Lynne Barratt, also kindly provided collections for this project. Jeremy Kemp, Gianna Minton, and Tim Collins also participated in the HTS expeditions. Voucher specimens have been deposited in the herbaria of the University of Michigan (MICH), the Natural History Museum of Oman (ON), Muscat, and the Natural History Museum (BM), London. Coordinates were obtained in the field by using several GPS devices.

1

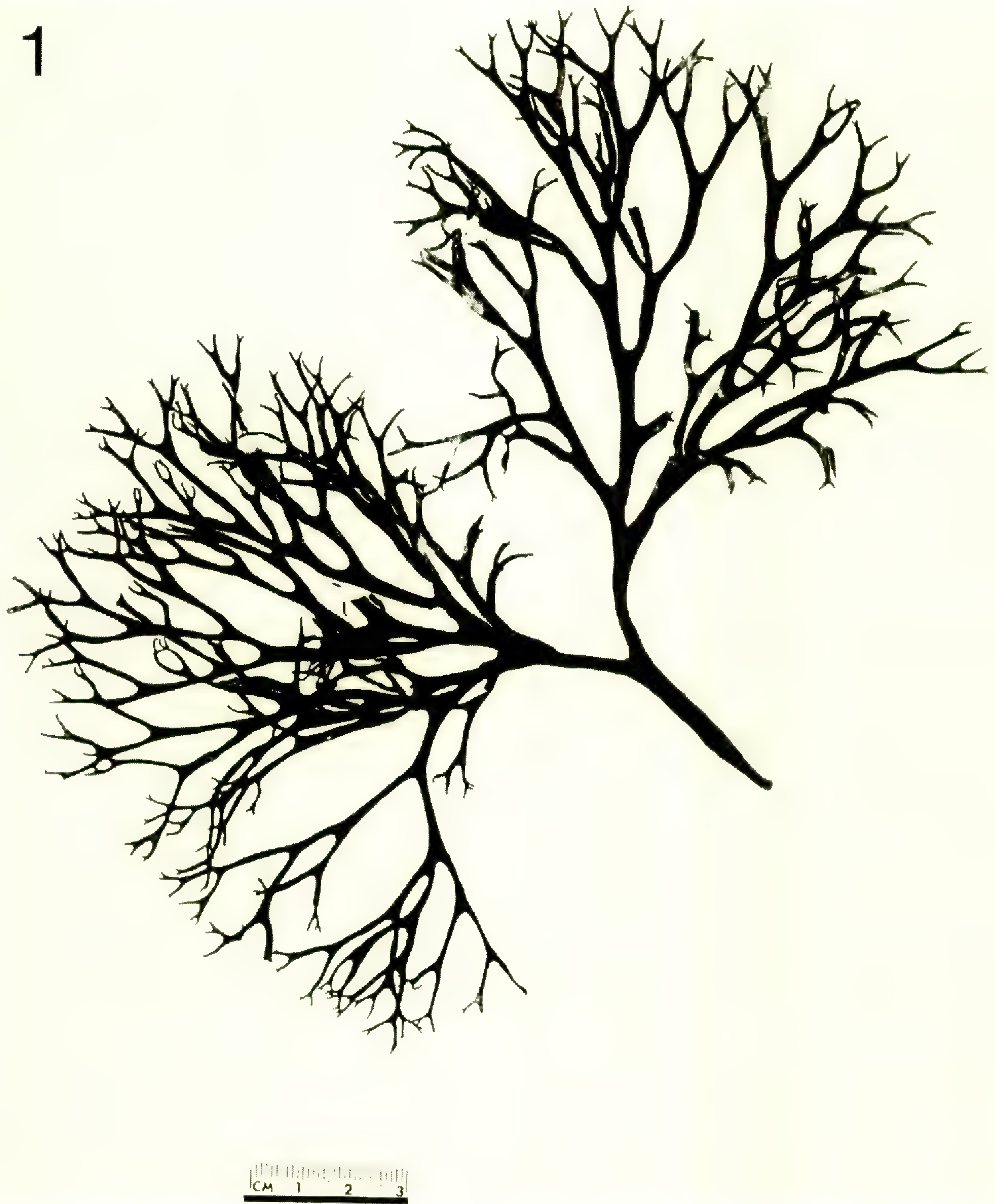


FIG. 1. *Dermonema abbottiae*. Herbarium specimen collected by L. Barratt, 20. viii. 1985.

RHODOPHYTA

NEMALIALES

Liagoraceae

Dermonema abbottiae Afaq-Husain, Nizamuddin & Shameel

Fig. 1.

OMAN. Wadi Forh (Lennon's Bay) (16.95833°N, 54.73166°E), Mirbat, 6 km east of Sadh, Dhofar: 20. viii. 1985, *leg. L. Barratt*, lower intertidal. Mirbat, Dhofar: 31. ix. 1983, *leg. TMRU*. Hoon's Bay (17.00517°N, 54. 15339°E), east of Mirbat, Dhofar: 10. ix. 2000, *leg. M. Wynne 10092000-03-12*, on mid-littoral rocks.

The specimens (Fig. 1) here determined to be *Dermonema abbottiae* are in agreement with the characteristics used by Afaq-Husain et al. (1991) in separating this species from others in the genus: the dark red color of the thalli, the compressed nature of the axes, the absence of terminal hairs on the assimilatory filaments, and the greater height than that of the type species, *D. virens* (J. Agardh) Pedroche & Avila Ortíz [formerly *D. frappieri* (Mont. & Millardet) Børgesen; see Pedroche & Avila Ortíz, 1996]. Our specimens were 8.0–11.5 cm in height. The description of *D. abbottiae* given by Afaq-Husain et al. (1991) gives a maximum height of 8 cm. Also, the 5 mm width of the major axes slightly exceeds the maximum 4 mm width stated in the description of *D. abbottiae*. These specimens were found growing in the lower intertidal in a moderately exposed site.

This species was described by Afaq-Husain et al. (1991) from near Cape Monze, Karachi, Pakistan. This is the first report of the taxon outside of Pakistan. Another species, *Dermonema zinovae*, was described by Nguyen Huu Dinh (1986) from Vietnam as having thalli 2.5–4.0 cm tall and axes 1.5–1.8 mm thick and as producing numerous proliferations from the basal parts of the thalli. It was also distinguished by having cells of the cortical filaments ovoid or oblong-ovoid rather than cylindrical.

GELIDIALES

Gelidiellaceae

Gelidiella ligulata E. Y. Dawson

OMAN. Shinzi, Masirah Island (20.57500°N, 58.93333°E): 6. ii. 1997, *leg. M. Wynne 10874 & 10879*, on intertidal rocks.

This species was first described by Dawson (1953) from Pacific Mexico. It was later reported from the Solomon Islands (Womersley & Bailey 1969) and recently from Japan (Shimada & Masuda 1999). *Gelidiella ligulata* is distinguishable from other species in the genus by its ligulate blades (to 4.5 cm tall), arising from creeping terete axes. Blades are typically unbranched and have undulate margins. Dawson (1953) said that older branches can become branched, and these branches were deciduous and possibly serving a means for vegetative propagation. According to Shimada and Masuda (1999) the deciduous nature of Dawson's material is uncertain and needs to be confirmed; it may have been an artefact of preservation. *Gelidiella indica* Sreenivasa Rao (1971) is similar in appearance to *G. ligulata* but has non-deciduous branches arranged marginally. If these two taxa prove to be conspecific, *G. ligulata* has nomenclatural priority.

GIGARTINALES

Gigartinaceae

Chondracanthus acicularis (Roth) Fredericq in Hommersand et al.

OMAN. Rock to east of Mirbat, Dhofar (16.95116°N, 54.74800°E): 28. ix. 1999, *leg. G. Richards 28999-04-10*, on rock, 12 m.

This alga consists of compressed axes, 1.0–1.8 mm wide and to 20 mm long, with widely separated pinnate branching to the second order. It formed small tufts showing horizontal growth, the axes becoming secondarily attached to the rock substrate. The texture was cartilaginous, and specimens did not adhere to the paper upon being pressed. Tips showed a multiaxial organization. Cross sections

of axes showed a loosely filamentous medulla and a cortex of branched, radially aligned, small-celled filaments. These features agree with the description of this species given by Dixon and Irvine (1977) for British material.

When the genus *Chondracanthus* Kützinger (1843) was resurrected by Hommersand et al. (1993) as a genus distinct from *Gigartina*, *G. acicularis* (Roth) Lamouroux was transferred to the segregate genus. According to Hommersand et al. (1993), this species has a distribution in the North and South Atlantic Oceans and the Mediterranean Sea, but there have been a number of old and recent reports of this species from throughout the Indian Ocean (Murray 1887; Børgesen 1935; Anderson & Stegenga 1989; Desikachary et al. 1998). A related species showing a similar turf-like habit is *Chondracanthus (Gigartina) intermedius* (Suringar) Hommersand, with a distribution in Japan (Okamura 1908; Yoshida 1998), China (Tseng 1983), Korea (Lee & Kang 1986), and eastern Australia (Millar 1990).

One of the features used by Hommersand et al. (1993) to separate *Chondracanthus* from *Gigartina* s.s. was the release of the tetraspores through pores in the wall in the former genus and the release of tetraspores by excision of the entire sorus in the latter genus. In the eight species of southern Australian representatives, Womersley (1994) observed no instances of the release of tetraspores through pores or an ostiole in the wall and thus treated them all within *Gigartina*. He expressed the opinion that *Chondracanthus* is “doubtfully distinct” from *Gigartina*.

***Chondracanthus teedei* (Mertens ex Roth) Kützinger**

OMAN. Grindstone Bay (16.95116°N, 54.81650°E): 22. ix. 1999, leg. J. Kemp 22999-01-02, on rock, 6 m; male.

This alga had a generally comparable habit to that of *Chondracanthus acicularis* in having distichous branching, but the primary axes were flattened, to 4.0–4.5 mm wide, and the secondary axes to 2.5 mm wide. Branching was to the third order. The internal structure consisted of a loose network of medullary filaments and a cortex of branching filaments 6–7 cells long. A distribution in the North and South Atlantic Oceans was reported by Hommersand et al. (1993) for this species. The record of *C. teedei* from the Seychelles by Untawale and Jagtap (1989) was regarded by Silva et al. (1996) as likely to represent the same species that had been reported from other Indian Ocean localities as *C. (Gigartina) acicularis*. Yet, the Omani material here identified as *C. teedei* and *C. acicularis* (above) is quite different in appearance in terms of overall size, width of the axes, and degree of branching.

RHODYMENIALES

Rhodymeniaceae

***Chrysomenia grandis* Okamura**

Figs. 2, 3.

OMAN. Mirbat Island, southeast of Mirbat, Dhofar (16.95000°N, 54.74583°E): 23. ix. 1999, leg. E. Dodsworth 23999-02-02, 11 m, on rock. Atery Cove (16.96094°N, 54.75627°E), east of Jazirat Hino, east of Mirbat, Dhofar: 13. ix. 2000, leg. G. Richards 13092000-06-21, sublittoral, cystocarpic. Grindstone Cove (16.95116°N, 54.81650°E), east of Mirbat, Dhofar: 18. ix. 2000, leg. M. Wynne 18092000-12-09, cystocarpic, in drift. “Reef Stingray Cove” (16.96091°N, 54.82795°E), east of Mirbat, Dhofar: 24. ix. 2000, leg. G. Richards & T. Collins 24092000-17-01, cystocarpic & tetrasporangiate, sublittoral.

2



FIG. 2. *Chrysomenia grandis*. Herbarium specimen collected by E. Dodsworth, Mirbat Island, 22. ix. 1999.

Chrysomenia grandis was originally described from Tateyama Bay, Honshu, Japan (Okamura 1933). This appears to be the first report of this species outside Japan, and it reinforces the concept that there is a high incidence of shared marine algal species between Japan and Oman (Børgesen 1934b; Wynne 2000). Various authors (Okamura 1933, pl. 301; Chihara 1975; Yoshida 1998) have depicted *C. grandis* as consisting of large tubular fronds that are elongate and filled with clear

3



FIG. 3. *Chrysomenia grandis*. Herbarium specimen collected by G. Richards and T. Collins, 24. ix. 2000.

mucous, or jelly, and this is true for the Omani specimens. Japanese thalli have been depicted as branched primarily near the base and then irregularly branched distally into finger-like segments. The Omani material, which otherwise is in agreement, has branches arising variously from along the primary axes and with branching to 2 or 3 orders (Figs. 2, 3). Omani specimens showed great variation in their dimensions. Most individual axes were 10–18 cm long, but older primary axes could reach 38 cm in length. Most axes were 12–19 mm wide, but occasional older axes reached 44 mm in width. The Omani specimens included tetrasporangiate and cystocarpic thalli. Kajimura (1977, 1998) has described the reproductive morphology of fertile material from Japan.

In describing two new species of *Chrysomenia* from the tropical western Atlantic, Norris and Ballantine (1995) provided a key to the eight species they recognized as occurring in that region. The thalli of their newly described species, *C. nodulosa* and *C. littleriana*, both reach comparable sizes to those of *C. grandis*, but they are much more densely branched than in *C. grandis*.

Lomentariaceae

Gelidiopsis variabilis (J. Agardh) Schmitz

OMAN. Sadh (17.05000°N, 55.07500°E), Dhofar: 1. xii. 1996, *leg. J. Stirn*.

Gelidiopsis variabilis, the type species of the genus, has a wide distribution in tropical seas, including the Indian Ocean (Silva et al. 1996) and the Caribbean (Littler & Littler 2000). Yoshida (1998) has reported *G. gracilis* (Kützinger) Feldmann from Japan, but this species has been treated as conspecific with *G. variabilis* by Norris (1987).

In recent years the genus *Gelidiopsis* had been assigned to the Rhodymeniaceae (Price & Kraft 1991; Silva et al. 1996; Wynne 1998a); however, Saunders et al. (1999) presented evidence based on molecular analyses to place it in the Lomentariaceae.

Champiaceae

Champia indica Børgeesen

Fig. 4

OMAN. On small island (16.95000°N, 54.74853°E), east of Mirbat, Dhofar: 23. ix. 1999, *leg. G. Richards* 23999-02-04, on rock, 12 m depth. Atery Cove (16.96094°N, 54.75627°E), east of Jazirat Hino, east of Mirbat, Dhofar: 13. ix. 2000, *leg. M. Wynne & G. Minton* 13092000-06-02, tetrasporangiate, attached at 7 m and in drift.

The Omani specimens (Fig. 4) are in general agreement with Børgeesen's (1933) description of this alga, its thalli reaching about 15 cm in height; however, the segment width of up to 5.5 mm is more robust than the width of 3.0 mm reported by Børgeesen. The cortex is single-layered, but the larger cortical cells cut off smaller cells from their corners, producing a discontinuous layer of these small cortical cells.

Reedman and Womersley (1976) pointed out the usefulness of the character of the distribution of the longitudinal filaments coursing in the interior of the thallus: either scattered over the central diaphragms and located at the periphery, or restricted to the periphery of the thallus. In the Omani specimens, these longitudinal filaments showed the scattered distribution in agreement with Børgeesen's description of their running "in the interior of the joints." Børgeesen (1933) regarded *C. indica* as related to *C. affinis* (Hooker & Harvey) J. Agardh of southern Australia and New Zealand. In the latter species the longitudinal filaments are restricted to the periphery of the interior of the thallus (Womersley 1996).

4



FIG. 4. *Champia indica*. Herbarium specimen collected by G. Richards, 23. ix. 1999.

CERAMIALES

Ceramiaceae

***Antithamnionella elegans* (Berthold) J. Price & D. John**

OMAN. Rock 500 m east of Mirbat Island, southeast of Mirbat, Dhofar (16.95116°N, 54.74800°E): 28. ix. 1999, *leg. E. Dodsworth* 28999-04-03, epiphytic on *Valoniopsis pachynema* (Martens) Børgesen, 12 m depth; *leg. E. Dodsworth* 28999-04-12, tetrasporangiate; epiphytic on *Chondria curvilineata*, 12 m depth.

The thalli consisted of both creeping and erect axes, and there were usually 3 subequal whorl-branches per segment. Prostrate axes were attached by whorl-branches developing into elongate, unicellular rhizoids; these whorl-branches were sometimes unicellular or few-celled. Whorl-branches usually reached only 9 cells in length. Gland cells were abundant, often in series of up to 3, and were produced on lateral cells remote from the tips of whorl-branches. This intercalary mode of formation and other features conform to *Antithamnionella elegans*. This species can be distinguished from *A. breviramosa* (Dawson) Wollaston and *A. verticillata* (Suhr) Lyle, in both of which species gland cells are produced terminally, and from *A. graeffei* (Grunow) Athanasiadis, with both laterally and terminally produced gland cells (Athanasiadis 1996). One of the collections included plants

bearing tetrasporangia. They are sessile, and are produced on periaxial cells and the second cells of whorl-branches. They show a cruciate-decussate cleavage pattern. Their measurements of 18–26 μm in height and 16–20 μm in diameter are smaller than the “to 40 $\mu\text{m} \times 23 \mu\text{m}$ ” reported by Athanasiadis (1996).

Antithamnionella flagellata (Børgesen) Abbott, which was described from Mauritius (Børgesen 1945), was treated as a synonym of *A. graeffei* by Athanasiadis (1996). The whorl-branches of *A. graeffei* also differ by their greater length, composed of up to 20 cells, whereas those of *A. elegans* reach up to only 12 cells. There have been prior reports of *A. elegans* from India (Dixit 1968) and Pakistan (Anand 1943). Desikachary et al.’s (1998) record from India included *A. breviramosa* as conspecific, following the proposal made by Cormaci and Furnari (1988), but Athanasiadis (1996) provided grounds for the separation of *A. elegans* and *A. breviramosa*, namely, the differing modes of gland cell formation.

Ceramium filiculum Harvey ex Womersley

OMAN. Sadh (17.05000°N, 55.07500°E), Dhofar: 1. xii. 1996, leg. J. Stirn (=Wynne 11068), epiphytic on coarse red algae. Wadi Haart, Dhofar: 29. ix. 1983, leg. TRMU, Univ. of York. Al Ashkarah (21.83333°N, 59.57500°E): 6. xi. 1992, leg. B. Jupp (OMAN 210), epiphytic on *Sarcodia*.

Ceramium filiculum was described from southern Australia by Womersley (1978) and has a discontinuous range extending from New South Wales to Western Australia (Huisman & Walker 1990; Millar 1990; Huisman 1997; Womersley 1998). According to Womersley (1998), it was depicted by Harvey (1862, pl. 206A, as “*C. miniatum* Suhr”). It was reported from the Seychelles with a query by Wynne (1995).

Delesseriaceae

Nitophyllum adhaerens M. J. Wynne

OMAN. Rock 500 m east of Mirbat Island, southeast of Mirbat, Dhofar (16.95116°N, 54.74800°E): 28. ix. 1999, leg. E. Dodsworth 28999-04-03, epiphytic on *Valoniopsis pachynema* (G. Martens) Børgesen, 12 m depth.

This species was originally described as occurring at various locations in the Caribbean Sea and from Bermuda; the type locality is in Quintana Roo, Mexico (Wynne 1997). Its range was extended significantly when it was reported from Hawaii (Abbott 1999). It is a small, monostromatic alga, the delicate blades becoming mutually connate by means of marginal rhizoids as well as by becoming closely attached to its algal hosts. Thus, it is easily overlooked or damaged when collected.

Myriogramme bombayensis Børgesen

OMAN. Ras Hamar (“Donkey’s Head”), west of Mughsayl (16. 25000°N, 53.90000°E): 26. ix. 1983, leg. S. Hiscock. Rock 500 m east of Mirbat Island, southeast of Mirbat, Dhofar (16.95116°N, 54.74800°E): 28. ix. 1999, leg. G. Richards 28999-04-11, 12 m, epiphytic on *Carpopeltis maillardii* (Mont. & Millardet) Chiang.

Although Hommersand and Fredericq (1997a, b) have placed the genera *Myriogramme* and *Schizoseris* in different tribes of the Delesseriaceae, some small-statured species assigned to these two genera remain poorly known. Børgesen (1931) described *Myriogramme bombayensis* from India as having small, stipitate blades, to about 3 cm tall, deeply lobed and with strongly developed, occasionally forking nerves. The lobes were depicted as becoming attached to one another by marginal rhizoids (Børgesen 1935).

Børgesen (1931) admitted that the presence of dichotomously divided nerves suggested a connection of his *Myriogramme bombayensis* with *Schizoseris*, but the species assigned to that genus were all larger forms (Ricker 1987). Over the years, a total of three species of small-statured *Schizoseris* have been described: *S. subdichotoma* (Segawa) Yamada (1944) (Segawa 1941; Cho & Boo 1998), *S. pygmaea* Dawson (1950, 1962), and *S. minima* Kaneko & Masaki (1973). Yoshida (1998) treated *S. minima* as a taxonomic synonym of *S. subdichotoma*, whereas Abbott (1999) has recently placed both *S. subdichotoma* and *S. pygmaea* within *M. bombayensis*. Nevertheless, Abbott admitted that until cystocarpic plants of *M. bombayensis* have been studied in terms of the criteria proposed by Hommersand and Fredericq (1997a, b), it will be uncertain as to which is the correct generic assignment for this taxon (or these taxa). The present treatment is to follow the lead of these other authors in assigning this small Omani delesseriacean alga to *Myriogramme*. This species has also been reported from eastern Australia (Cribb 1954, 1983).

Rhodomelaceae

Acanthophora dendroides Harvey

OMAN. Taqah: 22. ix. 1983. *leg. TMRU, Univ. of York*; littoral turf.

In their recent systematic treatment of *Acanthophora*, de Jong et al. (1999) recognized a total of seven species. *Acanthophora dendroides* has an Indian Ocean distribution, including its type locality of Rottnest Island, western Australia (Harvey 1855), Indonesia (Weber-van Bosse 1923), India (Børgesen 1934a), Tanzania (Jaasund 1976), and Pakistan (Shameel & Tanaka 1992). This record represents the first report of this species from Oman. It has been compared with an isotype specimen in MICH (*Harvey Aust. Exsicc. 139-a*), and although the single Omani specimen is only 6 cm tall and lacks the basal portion, otherwise it has been observed to be in agreement with de Jong's et al. (1999) concept of this species. The color is dark purple; the main axes are terete (0.5–1.0 mm in diameter) and densely branched. The determinate branches are basally constricted, with rounded apices and bearing 1 or 2 spines per branchlet. A stoloniferous base is characteristic of this species (de Jong et al. 1999).

PHAEOPHYTA

DICTYOTALES

Dictyotaceae

Dictyota cervicornis Kützinger

OMAN. Sadh (17.05000°N, 55.07500°E), Dhofar: 4. iii. 1987, *leg. L. Barratt*, 9 m.

Padina glabra Gaillard

OMAN. Cove between Taqah and Khor Rouri (17.02997°N, 54.43437°E), 2.3 km east of Taqah, east of Mirbat, Dhofar: 9. ix. 2000, *leg. M. Wynne 09092000-01-01*, attached to bottom of a deep tide pool.

The only previous report of *Padina glabra* from the Indian Ocean was that of Rengasamy and Anand (1986) from India. The species was originally described by Gaillard (1966) from Dakar, Senegal, West Africa, and distinguished from other species in the genus by the absence of hairs (its most distinctive feature), the lack of calcification, the (3–) 4 cell-layered organization, and the non-indusiate nature

of the sporangial sori. More recently, this species was reported from Florida by Wynne and De Clerck (1999), the first record from the western Atlantic.

The Omani specimens were abundant in a deep tide pool. The blades were 8.5–10.0 cm tall and often deeply split. They bore plantules in the region of the sori. The sori were located on both blade surfaces but were more abundant on the inferior face. The production of plantules in *Padina glabra* was reported in the Indian material (Rengasamy & Anand 1986) and in the Florida material (Wynne & De Clerck 1999).

***Padina somalensis* Hauck**

OMAN. Al Ayjah, Masirah Island (20.59166°N, 58.91666°E): 7. ii. 1997, *leg. M. Wynne 10916*.

This collection consisted of about a dozen blades, which are lightly calcified with a stupose base and mostly deeply split. Cross sections showed the blades to be four layers in thickness throughout the thallus. Sporangia occurred in broad bands in alternating hair zones. Because *Padina somalensis* had a minimal original description provided by Hauck (1887) and because it has been seldom reported in the literature (Sartoni 1975), the holotype was borrowed from Leiden (L #937.60-89) and examined. It was collected in February, 1873, from Scara, Somalia, and consists of two specimens showing moderate calcification on one surface. The specimens are 12.0–12.5 cm tall, very deeply dissected, and heavily epiphytized. There are alternating fertile and sterile zones, with the sori in extremely broad bands and also with very broad bands of densely set hairs (6–10 deep). The distance between successive soral bands is (3–) 6 mm. The hair bands on the opposite surface of the blade are also densely set. The blades are four layers in thickness. There are some shared features with *P. boergesenii* Allender & Kraft (1993), in particular the alternating sterile and fertile bands, but that species is (2–) 3 layers in thickness.

CHLOROPHYTA

BRYOPSIDALES

Bryopsidaceae

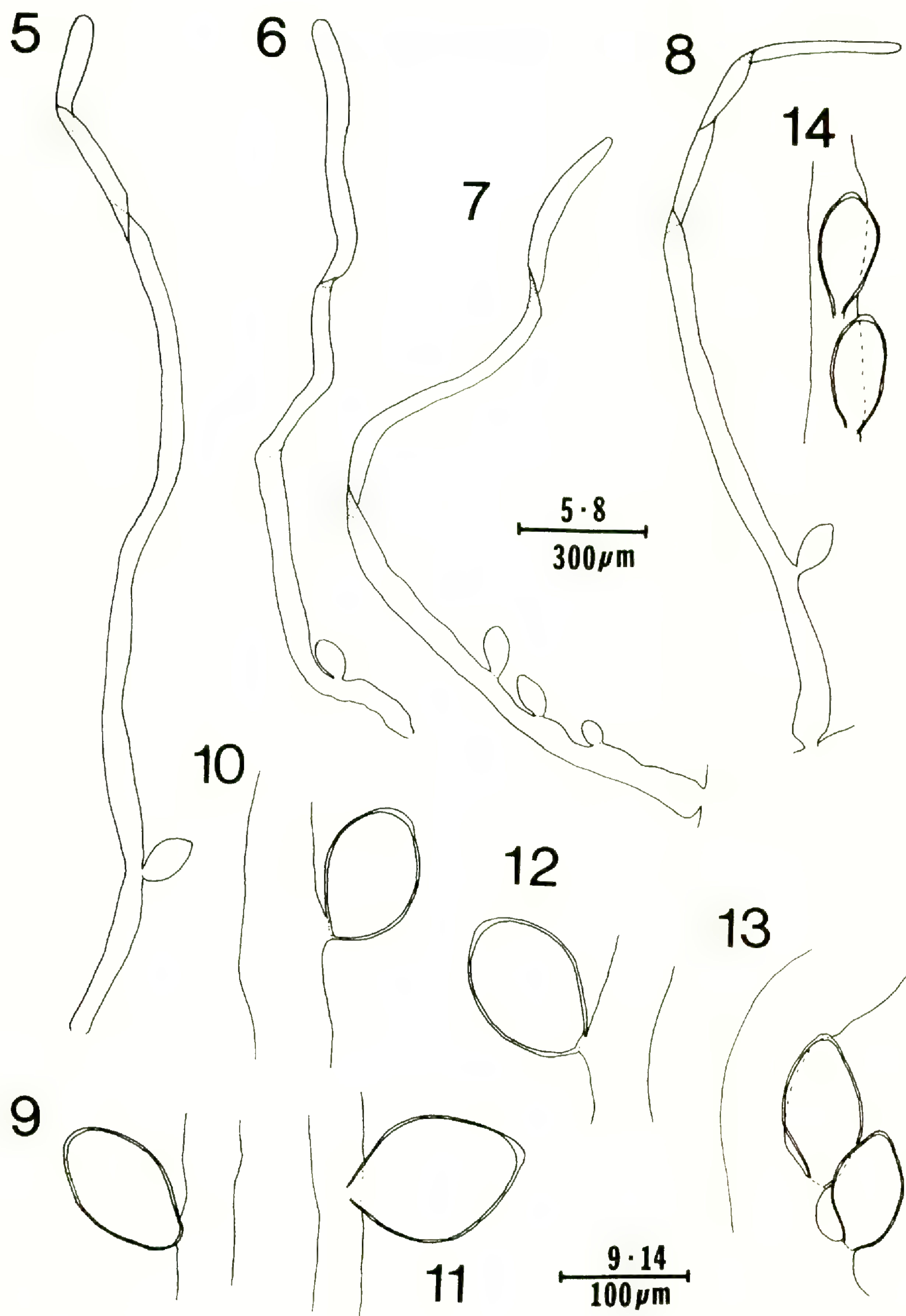
***Pseudobryopsis myura* (J. Agardh) Berthold**

Figs. 5–14

OMAN. Hoon's Bay (17.00517°N, 54. 15339°E), east of Mirbat, Dhofar: 26. ix. 2000, *leg. T. Collins 26092000-20-02*, in sand at 8.5 m; gametangial.

In their Indian Ocean catalogue, Silva et al. (1996) followed Taylor's (1962) taxonomic treatment of including *Pseudobryopsis* (Berthold in Oltmanns 1904) within the circumscription of *Trichosolen* (Montagne 1860). Subsequently, Henne and Schnetter (1999) offered evidence to treat these heterotypic genera as distinct. In their emended definitions of this pair of genera, Henne and Schnetter (1999) characterized *Pseudobryopsis* as having small chloroplasts without pyrenoids and having gametangia separated from the bearing axis by a plug, the contents emptied after discharge of the gametes. They described *Trichosolen* as having relatively large chloroplasts with pyrenoids and having gametangia that are in protoplasmic continuity with their bearing axes, such that following release of gametes the volume of the gametangium is refilled with protoplasm.

Henne and Schnetter (1999) assigned six species to *Pseudobryopsis*. Criteria that have been used in the recognition of these species include the following:



FIGS. 5–14. *Pseudobryopsis myura*. Camera-lucida drawings. FIGS. 5–8. Ramuli with gametangia borne in proximal region. FIGS. 9–14. Gametangia borne singly or in pairs per ramulus. Collected by T. Collins, 26. ix. 2000.

height, width, and degree of branching of the primary axes; length and width of the ramuli; shape and relative size (length and width) of the gametangia, and their number and location on the bearing ramulus; size of the chloroplasts (Kobara & Chihara 1978; Henne & Schnetter 1999). The type species, *P. myura* (J. Agardh) Berthold, is known from the Mediterranean. The height of Mediterranean *P. myura*

is quite variable, ranging from 3 to 15 cm (Hamel 1931; Feldmann 1937). The specimens that were the basis of Yendo's report of this species from Japan (Yendo 1915, as *Bryopsis myura*) were later shown to belong to *Bryopsis* (Chihara & Kobara 1995).

The single Omani specimen is robust, composed of many primary axes reaching 7 cm in height and 1.0 mm in diameter, and is densely fringed with determinate ramuli 1.2–2.2 mm long and 22–32 μm wide. The main axes are occasionally branched with similar indeterminate branches. Ramuli are constricted at their proximal ends. All along the primary axes the ramuli bear numerous gametangia most often near their proximal ends (Figs. 5–8) but sometimes on mid-regions, the gametangia somewhat hidden beneath the dense fringe of the ramuli. One (Figs. 9–12) or two (Figs. 13, 14) gametangia are borne per ramulus, but occasionally three gametangia were present per ramulus (Fig. 7). The gametangia (Figs. 8–14) are papillate at their apices and are narrowed toward their bases. There is slight evidence of a pedicel; many sporangia appear to be sessile or subsessile on the ramulus. Mature gametangia presented two appearances: with finely granular, yellowish contents or with coarsely granular dark greenish contents. These are regarded to be the male and female gametangia, respectively, corresponding to these two types depicted in Chihara and Kobara (1995) for *P. myura*. In the Omani specimen, the size of the gametangium is dependent on from what part of the primary axes this structure is measured. In the mid-portion of a primary axis gametangia were measured to be 40–54 μm wide (average of 50.4 μm based on 10 measurements) and 66–96 μm long (average of 91.6 μm based on 10 measurements). Gametangia that were measured in a more proximal region of a primary axis were 46–66 μm wide (average of 57.3 μm based on 10 measurements) and 86–128 μm long (average of 107.5 μm based on 10 measurements). The range of gametangial sizes when compared with those presented by Kobara and Chihara (1978, fig. 32) for the three species, *P. myura*, *P. hainanensis*, and *P. oahuensis* shows that the Omani material best conforms to the size range of *P. myura*. The width-length range corresponds to that given by Feldmann (1937) and also covers much of the broader size range later reported by Feldmann (1969) and by Mayhoub (1974) for Syrian material.

Pseudobryopsis hainanensis was described by Tseng (1936) from Hainan Island, Guangdong Province, China, and was regarded to be endemic to that region (Tseng 1983), but it has been reported from southern Japan (Kobara & Chihara 1978; Okuda et al. 1987). Tseng (1936) described the primary axis in *P. hainanensis* to reach only 2.2 cm in height, whereas Japanese material identified as *P. hainanensis* was stated to be 1.0–4.0 cm (Kobara & Chihara 1978) and to reach 3–10 cm in culture (Okuda et al. 1979, as *P. sp.*; Okuda et al. 1987). Although Tseng (1936) described a single gametangium per ramulus, Japanese workers (Kobara & Chihara 1978; Okuda et al. 1979, as *P. sp.*) have shown there may be 1, 2, or 3 gametangia per ramulus. With some reservation, Norris (1992) reported *P. hainanensis* from northern Natal, South Africa, but reported his material to have somewhat larger ramuli ("pinnae") and gametangia than reported in typical specimens. The Natal specimens were reported to reach a maximum height of 3.0 cm. The Omani specimen is not identified as *P. hainanensis*, because the gametangia in that species are significantly smaller (36–52 μm wide and 52–78 μm long according to Tseng, 1936; 35–75 μm wide and 55–105 μm long, according to Kobara & Chihara, 1978). Thallus size is generally smaller in *P. hainanensis*, and the ramuli are shorter (only 1.2 mm long).

Egerod (1952) described *P. oahuensis* from Hawaii as 3–5 cm tall, bearing ovate, pedicellate, terminally papillate gametangia 60–75 μm wide and 135–150 μm long. There is some overlap in this gametangial size range with that reported for *P. myura* (Mayhoub 1974; Kobara & Chihara 1978). Egerod followed the erroneous literature concerning *P. myura* in thinking that its gametangia lacked an apical papilla and that its chloroplasts had pyrenoids. Later workers (Chihara & Kobara 1995) showed that *P. myura* has papillate gametangia and chloroplasts without pyrenoids. Numerous specimens of *P. oahuensis* in MICH collected by W. J. Gilbert and A. J. Bernatowicz have been examined. The height of the plants ranges from 2.0 to 10.0 cm, and the ramules are often to 2.0 mm long. Primary axes are most often simple. According to Egerod (1952), up to five gametangia can be borne per ramulus, a number that has not ever been reported for *P. myura*.

Nasr (1941) described *Pseudobryopsis papillata* from the Red Sea, and so far it seems to be restricted to the Red Sea. Nasr's plant reached a height of 15 cm. It clearly is distinguishable because of its repeatedly subdichotomous branching and the greater length (3–4 mm) of the ramuli. Also, the gametangia are globular to obovate (50–65 μm wide and 70–90 μm long), smaller than the gametangia in the Omani plant.

Other species of the genus reported from the Indian Ocean include *Pseudobryopsis thikkodiensis*, described from India by Anil Kumar and Panikkar (1993). That species is distinct because of its small stature (to 1.5 cm height), the short ramuli, and the production of a single gametangium from each ramulus.

Codiaceae

Codium duthieae P. Silva in Silva & Womersley

OMAN. Mirbat, Dhofar: 31. ix. 1984, *leg. TMRU*. Dawwah, Masirah Island (20.55000°N, 58.80833°E): 6. ii. 1997, *leg. M. Wynne 10942*, in drift.

This report represents the first record of this species from Oman. The type locality of this species is Strandfontein, False Bay, Cape Prov., South Africa (Silva & Womersley 1956), but it is also known from Mozambique, Kenya, and Australia (Womersley 1984; Silva et al. 1996; Van den heede & Coppejans 1996). It is a dichotomously or subdichotomously branched species. Axes may be entirely cylindrical, as they are in the Omani material, or they can be terete with flattening at the dichotomies, or with flattening almost throughout (Silva 1959). It is the relatively large size of the utricles that is one of the distinguishing characteristics for this species. They range (220–) 465–560 (–780) μm in diameter near their apices and 1200–1400 μm in length. The utricles are thin-walled and not capitate or ornamented at their tips.

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THE TRIBES OF THE DELESSERIACEAE (CERAMIALES, RHODOPHYTA)

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ABSTRACT. Twenty-three tribes are recognized in the red algal family Delesseriaceae (Ceramiales). The constituent genera had been assigned traditionally to informally recognized categories called “Gruppen,” or Groups. Seven of these Groups had been previously converted to tribes (Delesseriaceae, Dicroglosseae, Hemineureae, Myriogrammeae, Nitophylleae, Sarcomenieae, Schizoserideae), and the remaining 16 Groups are proposed as tribes here: Botryocarpeae, Caloglosseae, Claudeae, Congregatocarpeae, Cryptopleureae, Cumathamnieae, Grinnelliae, Hypoglosseae, Martensiae, Membranoptereae, Papenfussiae, Phycodryae, Pseudophycodryae, Sympodophylleae, Valeriemayeae, Zinovaeae.

INTRODUCTION

When Kylin (1924) produced his monograph of the red algal family Delesseriaceae, he proposed at the suprageneric level a number of “Gruppen,” or Groups. These categories were not formal taxonomic ranks but merely informal clusters of related genera and sometimes monotypic placements, representing Kylin’s ideas on relationships above the generic level and below the subfamily level. For the most part these so-called “Groups” have persisted and continue to be used by many workers (Wagner 1954; Kylin 1956; Shepley & Womersley 1960; Mikami 1973; Millar 1990; Wynne 1996). Yet, there have been some attempts to give formal taxonomic recognition to these groups as tribes. Some tribe names were used by Kraft and Woelkerling (1981, 1990), but not all of these names have yet been validated. In recent years a few new names of tribes have been established, such as Dicroglosseae of Millar and Huisman (1996) for their new genus *Dicroglossum*. In their studies of genera within the “*Myriogramme* Group” Hommersand and Fredericq (1997a, b) concluded that this “Group” comprised disparate elements. In dividing it into two assemblages, they delineated the two new tribes Myriogrammeae and the Schizoserideae. At this time it seems desirable to codify the traditional Kylinian system by giving formal taxonomic recognition to the remaining “Groups” within this family as well as listing those that have already been recognized. Thus, a baseline is established with all the remaining tribal names becoming validated at the same time. It is anticipated that future studies, especially those using molecular methods, will possibly call for emendations of these tribes. It is important that we have a system of valid tribal names that will serve us for the present and for future systematists.

The sequence in which the tribes are presented here reflects the very approximate phylogenetic arrangement (from simpler to more derived forms) that has been traditionally applied to the Delesseriaceae.

TRIBES OF DELESSERIACEAE

Delesseriaceae Bory (1828, p. 181, 'Delesseriae').—TYPE: *Delesseria* Lamouroux (1813).

I. Delesserioidae Kylin (1923, p. 113, 'Delesserieae').—TYPE: *Delesseria* Lamouroux (1813).

Hypoglosseae M. J. Wynne, trib. nov.—TYPE: *Hypoglossum* Kützinger (1843, p. 444).

Thalli cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii absentes; initia omnia serierum cellularum ordinis secundii et tertii marginem thalli attingentia; procarpia cellulis ordinis primarii restricta, ex cellulis et adaxialibus et abaxialibus (transversalibus) pericentralibus producta; tetrasporangia cellulis corticalibus laminarum plerumque formata, soro duorum plusve stratorum producto, rarius tantum strato primario cellularum formata; in speciebus nonnullis cellulae pericentrales tetrasporangiis contribuentes.

Thalli grow by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are absent in primary cell rows. All second- and third-order initials reach the thallus margin. Procarps are restricted to primary axial row of fertile blades and are produced by both adaxial and abaxial (transverse) pericentral cells. Each procarp consists of one carpogonial branch and two groups of sterile cells. Tetrasporangia are usually produced by cortical cells of the blades, resulting in a sorus of two or more layers. More rarely, tetrasporangia are produced only by the primary layer of cells. In some species pericentral cells participate in the production of tetrasporangia.

In addition to *Hypoglossum*, this tribe includes *Bartoniella* Kylin, *Branchioglossum* Kylin, *Chauviniella* Papenfuss, *Duckerella* M. J. Wynne, *Frikkiella* M. J. Wynne & C. W. Schneider, *Phitycolax* M. J. Wynne & F. Scott, *Phitymophora* J. Agardh, *Pseudobranchioglossum* Bodard, *Tsengiella* Zhang & Xia, *Yoshidaphycus* Mikami, and *Zellera* von Martens.

Dicroglosseae Millar & Huisman (1996, p. 128).—TYPE: *Dicroglossum* Millar & Huisman (1996).—This is a monotypic tribe.

Sarcomenieae J. Agardh (1863, p. 794).—TYPE: *Sarcomenia* Sonder (1845).—Other genera included are *Cottoniella* Børgesen, *Dotyella* Womersley & Shepley, *Malaconema* Womersley & Shepley, *Platysiphonia* Børgesen, and *Sarcotrichia* Womersley & Shepley.

Zinovaeae M. J. Wynne, trib. nov.—TYPE: *Zinovaea* M. J. Wynne (1970, p. 136).

Thalli axibus sympodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii et secundarii praesentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; tetrasporangia in laminis similibus stichidiis portata; procarpia cellulis ordinis primarii laminarum fertilium restricta; carposporangia in catenis producta.

Thalli have a ramosympodial organization (growth in individual blades soon ceasing and continually being replaced by laterals). Growth is by means of a single transversely dividing apical cell terminating each axis. Intercalary cell divisions occurring in first- and second-order cell rows. Not all tertiary initials reach the blade

margin. Tetrasporangia are borne in stichidia-like bladelets. Procarps are restricted to primary axial row of fertile blades. Carposporangia are produced in chains.

In addition to *Zinovaea*, this tribe includes *Kurogia*. The tribe corresponds to the “*Kurogia* Group” of Yoshida (1979), but the tribe is here based on the older generic name.

Membranoptereae M. J. Wynne, trib. nov.—TYPE: *Membranoptera* Stackhouse (1809, p. 55).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in omnibus seriebus absentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; procarpia cellulis ordinis primarii laminarum fertilium restricta; procarpia ex ambabus paginis laminae formata (ex cellulis pericentralibus et dorsalibus et ventralibus); procarpium quodque ex ramulo carpogoniali atque catervis duabus cellularum sterilium constans; tetrasporangia in soris in paginis laminarum usitatarum, in foliolis marginalibus, vel in proliferationibus specialibus formata.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are absent in all cell rows. Not all third-order initials reach the thallus margin. Procarps are restricted to primary axial row of fertile blades. Procarps are formed from both blade surfaces (from both dorsal and ventral pericentral cells). Each procarp consists of one carpogonial branch and two groups of sterile cells. Tetrasporangia are produced in sori on the surfaces of ordinary blades, on marginal bladelets, or on special proliferations.

In addition to *Membranoptera*, this tribe includes *Austrofolium* M. J. Wynne, *Holmesia* J. Agardh, *Neoholmesia* Mikami, and *Pantoneura* Kylin.

Hemineureae Lin, Hommersand & Kraft (2001, in press).—TYPE: *Hemineura* Harvey (1849).—Although the “*Hemineura* Group” has been traditionally treated as monotypic (Kylin 1924, 1956; Wynne 1996), Lin et al. (2001) have a broader circumscription of their tribe and include also *Botryocarpa*, *Laingia*, *Marionella*, *Patulophycus*, and *Pseudophycodrys*. These genera have been assigned to other tribes in the above scheme.

Sympodophylleae Shepley & Womersley, trib. nov.—TYPE: *Sympodophyllum* Shepley & Womersley (1960, p.386).

Thalli axibus sympodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum absentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; series cellularum ordinis secundi venas microscopicas laterales facientes; tetrasporangia cellulis primariis formata, ex cellulis lateralibus pericentralibus atque cellulis successivis serierum secundi ordinis producta, uno strato in lamina fertili effecto; plantae sexuales ignotae.

Thalli have a ramosympodial organization (growth in individual blades soon ceasing and continually being replaced by laterals). Growth is by means of a single transversely dividing apical cell terminating each axis. Intercalary cell divisions are absent. Not all tertiary initials reach the blade margin. Second-order cell rows form microscopic lateral veins. Tetrasporangia are produced by primary cells and are cut off from the lateral pericentral cells and successive cells of the second-order rows, resulting in a single layer in the plane of the blade. Gametophytes unknown.

Shepley and Womersley (1960) recognized this genus as representing a new "Group" of Delesserioideae and even provided a Latin diagnosis, but they did not provide a tribe designation. They are credited here as authors of this new monotypic tribe.

Delesserieae Schmitz (1892, p. 113).—TYPE: *Delesseria* Lamouroux (1813).—Other genera included are *Apoglossocolax* Maggs & Hommersand, *Apoglossum* J. Agardh, *Heteroglossum* Zinova, *Laingia* Kylin, *Marionella* F. Wagner, *Microrhinus* Skottsberg, *Odontolaingia* Mendoza, *Patulophycus* Millar & M. J. Wynne, *Phycodrina* M. J. Wynne, *Pseudogrinnellia* M. J. Wynne, and *Pseudolaingia* Levring.

Cumathamnieae M. J. Wynne, trib. nov.—TYPE: *Cumathamnion* M. J. Wynne & Daniels (1966, p. 26).

Thalli axibus sympodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii absentes sed in seriebus ordinis secundi praesentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; tetrasporangia in laminis planis formata; procarpia cellulis ordinis primarii laminarum fertilium restricta; procarpia ex cellulis abaxialibus pericentralibus producta; procarpium quodque ex ramulo carpogoniali atque duabus catervis cellularum sterilium constans; carposporangia in catenis producta.

Thalli have a ramosympodial organization (growth in individual blades soon ceasing and continually being replaced by laterals). Growth is by means of a single transversely dividing apical cell terminating each axis. Intercalary cell divisions occurring in second-order cell rows, but not in first-order rows. Not all tertiary initials reach the blade margin. Tetrasporangia are borne in flat blades. Procarps are restricted to primary axial row of fertile blades. Procarps are produced by abaxial pericentral cells, each consisting of one carpogonial branch and two groups of sterile cells. Carposporangia are produced in chains.

This is a monotypic tribe.

Grinnellieae M. J. Wynne, trib. nov.—TYPE: *Grinnellia* Harvey (1853, p. 91).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii absentes sed in seriebus ordinum elatiorum praesentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; procarpia in laminis minimis notabilibus per paginam primariae laminae dispersis producta, cellulis ordinis primarii harum laminarum fertilium restricta; procarpium quodque ex ramulo carpogoniali atque duabus catervis cellularum sterilium constans; thalli masculi typice minores, soros spermatangiales dispersos per paginam laminae ferentes; tetrasporangia in soris discretis, dispersis per paginam laminae formata.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are absent in first-order but occur in higher-order cell rows. Not all third-order initials reach the thallus margin. Procarps are produced on minute distinctive bladelets, which are scattered over the surface of the primary blade; the procarps are restricted to the primary axial row of these fertile blades. Each procarp consists of one carpogonial

branch and two groups of sterile cells. Male thalli are typically smaller, bearing scattered spermatangial sori over blade surface. Tetrasporangia formed in discrete, scattered sori over blade surface.

This is a monotypic tribe.

Caloglosseae M. J. Wynne, trib. nov.—TYPE: *Caloglossa* (Harvey) G. von Martens (1869, p. 234, 237).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii absentes; initia omnia serierum cellularum ordinis secundii et tertii marginem thalli attingentia; trichomata originis exogene praesentia (primordia eorum initia primaria ante formationem cellularum pericentralium producta); procarpia cellulis ordinis primarii laminarum fertilium restricta, ex cellulis et abaxialibus et adaxialibus pericentralibus producta; procarpium quodque ex ramulo carpogoniali atque duabus catervis cellularum sterilium constans; carposporangia in catenis brevibus producta; tetrasporangia cellulis primariis formata.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are absent in primary cell rows. All second- and third-order initials reach the thallus margin. Exogenously produced branches or hairs are present (their primordia are cut off from the primary initial prior to the formation of pericentral cells). Procarps are restricted to primary axial row of fertile blades. They are formed from both blade surfaces, that is, from both dorsal and ventral transverse pericentral cells. Each procarp consists of one carpogonial branch and two groups of sterile cells. Carpospores are produced in short chains. Tetrasporangia are produced by primary cells.

In addition to *Caloglossa*, this tribe includes *Taenioma* J. Agardh.

Claudeeae (Kützing) M. J. Wynne, trib. et stat. nov.; basionym: Claudeaceae Kützing (1843, p. 442, 451, family 'Claudieae').—TYPE: *Claudea* Lamouroux (1813, p. 121).

Thalli have monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Thalli are in the form of a network (weakly developed in some species). Intercalary divisions are absent in primary cell rows. A fifth pericentral cell is formed from alternate segments (that is, a second ventral pericentral cell in *Claudea* and a second dorsal pericentral cell in *Vanvoorstia*). All second- and third-order initials reach the thallus margin. Procarps are restricted to primary axial row of fertile blades. They are formed from only one series (abaxial) of transverse pericentral cells. Each procarp consists of one carpogonial branch and two groups of sterile cells. Carposporangia are produced singly. Cystocarps are pedicellate. Tetrasporangia are formed in tertiary blades and are cut off by both primary and cortical cells; most of the fertile blade is converted into a sorus.

In addition to *Claudea*, this tribe includes *Vanvoorstia* Harvey.

Botryocarpeae (Kützing) M. J. Wynne, trib. et stat. nov.; basionym: Botryocarpaceae Kützing (1843, p. 442, 445, family 'Botryocarpeae').—TYPE: *Botryocarpa* Greville (1830).

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are absent in first- or higher-order cell rows. Third-order cell rows are rarely formed. Thalli are branched from the margin and polystromatic. An indistinct midrib is evident in proximal parts of thallus; lateral veins are absent. Reproductive organs are produced in special proliferations, in clusters. Procarps are produced on both transverse and lateral pericentral cells on both blade surfaces. Each procarp consists of one carpogonial branch and two groups of sterile cells. Carposporangia are produced singly or in chains of two. Tetrasporangia are formed by sub-surface cells and at maturity cover most of the surface of fertile proliferations.

This is a monotypic tribe.

Congregatocarpeae M. J. Wynne, trib. nov.—TYPE: *Congregatocarpus* Mikami (1971, p. 245).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus cellularum ordinis secundarii praesentes, in seriebus cellularum ordinis primarii raro praesentes; cellulae summae ordinis tertii haud omnes marginem thalli attingentes; costa ex multis cellulis elongatis rhizoideorum similibus constans; procarpia cellulis ordinis primarii laminarum fertilium restricta, in ambabus paginis laminae formata (ex cellulis pericentralibus et dorsalibus et ventralibus); procarpia in laminis usitatis (*Tokidadendron*) vel in proliferationibus specialibus (*Congregatocarpus* et *Neohypophyllum*) locata; procarpium quodque ex ramulo carpogoniali atque duabus catervis cellularum sterilium constans; tetrasporangia in paginis laminarum usitatarum (*Congregatocarpus* et *Tokidadendron*) vel in proliferationibus specialibus (*Neohypophyllum*) locata; plantae masculae ignotae.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions occur in second-order rows and rarely occur in first-order rows. Not all third-order initials reach the thallus margin. Midrib consists of many elongate rhizoidal cells. Procarps are restricted to primary cell rows and are formed on both blade surfaces. Procarps are located in ordinary blades (*Tokidadendron*) or in special proliferations (*Congregatocarpus* and *Neohypophyllum*). Procarps bear a carpogonial branch and two groups of sterile cells. Tetrasporangia are located over the surface of ordinary blades (*Congregatocarpus* and *Tokidadendron*) or in special proliferations (*Neohypophyllum*). Male plants are unknown.

In addition to *Congregatocarpus*, this tribe includes *Neohypophyllum* M. J. Wynne and *Tokidadendron* M. J. Wynne.

II. Nitophylloideae Kylin (1923, p. 114, 'Nitophylleae').—TYPE: *Nitophyllum* Greville (1830).

Pseudophycodryeae M. J. Wynne, trib. nov.—TYPE: *Pseudophycodrys* Skottsberg (1923, p. 32).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; divisiones intercalares cellularum in seriebus ordinis primarii et ordinum elatiorum praesentes; costa thallorum rhizoideis deorsum crescentibus instructa; procarpia (cystocarpia) per paginam laminae fertilis prope venas (*Pseudophycodrys*)

dispersa vel in proliferationibus specialibus ex costa et venis laminae primariae exorientibus formata, aut secus venas laterales (*Pseudonitophylla*); sori tetrasporangiales per paginam laminarum usitatarum locati.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Intercalary divisions are present in first- and higher-order cell rows. Thalli have a midrib with downward-coursing rhizoids. Procarps (cystocarps) are scattered over the surface of the fertile blade near veins (*Pseudophycodrys*) or located on special proliferations arising from the midrib and nerves of the primary blade, along the lateral veins (*Pseudonitophylla*). Tetrasporangial sori are located over the surface of ordinary blades.

In addition to *Pseudophycodrys*, this tribe includes *Pseudonitophylla* Mendoza.

Phycodryeae M. J. Wynne, trib. nov.—TYPE: *Phycodrys* Kützinger (1843, p. 444).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; series cellularum ordinis tertii ex seriebus cellularum ordinis secundarii abaxialiter exorientes; divisiones intercalares cellularum in seriebus ordinis primarii et ordinum elatiorum praesentes; costa thallorum sine rhizoideis deorsum crescentibus; procarpia per paginam laminae fertilis dispersa, exramulo carpogoniali atque catervis duabus cellularum sterilium aut duobus ramulis carpogonialibus atque una caterva cellularum sterilium constantia; carposporangia terminaliter in catenis ramosis portata; tetrasporangia ex cellulis corticalibus in ambabus paginis laminae formata; sori in laminis usitatis vel foliolis marginalibus formati vel proliferationibus specialibus fertilibus restricti.

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Apical organization involves the second-order cell rows producing third-order cell rows abaxially. Intercalary divisions are present in first- and higher-order cell rows. Thalli have a midrib without downward-coursing rhizoids. Procarps are scattered over the surface of the fertile blade. Procarps consist of either one carpogonial branch and two sterile-cell groups or two carpogonial branches and one sterile-cell group. Carposporangia are borne terminally in branched chains. Tetrasporangia are formed from cells within the cortex on both blade surfaces; sori are formed on ordinary blades or on marginal bladelets or are restricted to special fertile proliferations.

In addition to *Phycodrys*, this tribe includes *Anisocladella* Skottsberg, *Asterocolax* J. Feldmann & G. Feldmann, *Calloseris* J. Agardh, *Cladodonta* Skottsberg, *Crassilingua* Papenfuss, *Erythroglossum* J. Agardh, *Halicnide* J. Agardh, *Haraldia* J. Feldmann, *Heterodoxia* J. Agardh, *Mikamiella* M. J. Wynne, *Nienburgella* Perestenko, *Nienburgia* Kylin, *Polyneura* Kylin, *Sorella* Hollenberg, *Sorellocolax* Yoshida & Mikami, *Womersleya* Papenfuss, and *Yendonia* Kylin.

Papenfussieae M. J. Wynne, trib. nov.—TYPE: *Papenfussia* Kylin (1938, p. 15).¹

Thalli sunt laminae erectae, irregulariter lobatae vel sinuosae, sine costa venisve. Thalli axibus monopodialiter evolutis; cellula unica apicali transverse

¹The genus *Papenfussia* as here interpreted includes a species described by Yoshida and Mikami (1990) in *Pollexfenia*. Thus, the combination is here proposed: *Papenfussia japonica* (Yoshida & Mikami) M. J. Wynne, comb. nov.; basionym: *Pollexfenia japonica* Yoshida & Mikami, *Phycologia* 29: 200, figs. 1–26. 1990.

divisa crescentes; series cellularum ordinis tertii ex seriebus cellularum ordinis secundarii adaxialiter exorientes; divisiones intercalares cellularum in seriebus ordinis primarii et ordinum elatiorum praesentes; regiones distales laminarum monostromaticae, regiones centrales atque proximales polystromaticae; procarpia per paginam laminae fertilis dispersa, simplicia, ex uno ramulo carpogoniali atque una caterva cellularum sterilium (una cellula) constantia; cystocarpia per regiones distales thalli dispersa; carposporangia terminalia; sori tetrasporangiales per regiones distales thalli dispersi.

Thalli are erect blades, irregularly lobed or sinuose, lacking midrib and nerves. Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Apical organization involves the second-order cell rows producing third-order cell rows adaxially. Intercalary divisions are present in first- and higher-order cell rows. Distal regions of blades are monostromatic; central and lower regions are polystromatic. Procarps are scattered over the surface of the fertile blade. Procarps are simple, consisting of only a single carpognial branch and one sterile-cell group (of one cell). Cystocarps are scattered over the distal thallus portions. Carposporangia are terminal. Tetrasporangial sori are distributed over the distal thallus parts.

This is a monotypic tribe.

Valeriemayae M. J. Wynne & Millar, trib. nov.—TYPE: *Valeriemaya* Millar & M. J. Wynne (1992, p.132).

Thalli axibus monopodialiter evolutis; cellula unica apicali transverse divisa crescentes; series cellularum ordinis tertii ex seriebus cellularum ordinis secundarii adaxialiter exorientes; divisiones intercalares cellularum in seriebus ordinis primarii et ordinum elatiorum praesentes; procarpia per paginam laminae fertilis dispersa; procarpia (illa cognita) varie constructa, ex ramulo carpogoniali atque una caterva cellularum sterilium cum cellula tegenti consociata aut ramulo carpogoniali atque una caterva multarum cellularum sterilium sine cellula tegenti constantia; carposporangia terminaliter (*Polyneuropsis*) vel in catenis brevibus (*Calonitophyllum*) formata; sori tetrasporangiales per omnem paginam thalli dispersi (*Calonitophyllum*), in segmentis ultimis thalli (*Radicilingua*) locati, soro singulari vel numero limitato restricti (*Valeriemaya*), vel proliferationibus specialibus fertilibus restricti (*Polyneuropsis*).

Thalli have a monopodial organization, growing by means of a single transversely dividing apical cell terminating each axis. Apical organization involves the second-order cell rows producing third-order cell rows adaxially. Intercalary divisions are present in first- and higher-order cell rows. Procarps are scattered over the surface of the fertile blade. Procarps (where known) are variously constructed, consisting of either a single carpognial branch and a sterile-cell group associated with a cover cell or a carpogonial branch and one sterile cell group of several cells, sterile-cell group not associated with a cover-cell. Carposporangia are produced terminally (*Polyneuropsis*) or in short chains (*Calonitophyllum*). Tetrasporangial sori are scattered over entire surface of thallus (*Calonitophyllum*), located in ultimate segments of the thallus (*Radicilingua*), restricted to a single sorus or a limited number (*Valeriemaya*), or restricted to special fertile proliferations (*Polyneuropsis*).

In addition to *Valeriemaya*, this tribe includes *Calonitophyllum* Aregood, *Polyneurella* E. Y. Dawson, *Polyneuropsis* M. J. Wynne, D. McBride & J. A. West, and *Radicilingua* Papenfuss.

Martensieae M. J. Wynne, trib. nov.—TYPE: *Martensia* Hering (1841, p. 92).

Thalli reticulo vel macula constructi, ex laminis crescentibus initiis oblique dividantibus secus marginem atque divisionibus intercalaribus constantes; costae macroscopicae et venae microscopicae absentes; procarpia et cystocarpia per paginam laminae fertilis dispersa; carposporangia terminaliter (*Martensia*) vel in catenis brevibus (*Neomartensia*) formata; tetrasporangia in partibus foliosis basalibus et in dissepimentis reticuli distalis portata.

Thalli have a network or meshwork organization. Thalli consist of blades growing by means of obliquely dividing initials along the margins and intercalary divisions. Macroscopic and microscopic nerves are absent. Procarps and cystocarps are scattered over the surface of the fertile blade. Carposporangia are formed terminally (*Martensia*) or in short chains (*Neomartensia*). Tetrasporangia are produced on the foliose basal portions and within the partitions of the distal meshwork.

In addition to *Martensia*, this tribe includes *Neomartensia* Yoshida & Mikami and *Opephyllum* von Martens.

Myriogrammeae Hommersand & Fredericq (1997a, p. 119).—TYPE: *Myriogramme* Kylin (1924).—Other genera included are *Gonimocolax* Kylin, *Haraldio-phyllum* Zinova, *Hideophyllum* Zinova, and *Platyclinia* J. Agardh.

Schizoserideae Hommersand & Fredericq (1997b, p. 488).—TYPE: *Schizoseris* Kylin (1924).—Other genera included are *Abroteia* J. Agardh, *Drachiella* Ernst & J. Feldmann, *Neuroglossum* Kützinger, and *Polycoryne* Skottsberg.

Nitophylleae Schmitz (1892, p. 113).—TYPE: *Nitophyllum* Greville (1830).—This tribe includes also *Arachnophyllum* Zanardini.

Cryptopleureae M. J. Wynne, trib. nov.—TYPE: *Cryptopleura* Kützinger (1843, p. 444).

Thalli ex laminis crescentibus initiis oblique dividantibus secus marginem atque divisionibus intercalaribus constantes; costae macroscopicae et venae microscopicae plerumque praesentes; cellulae multinucleatae, nucleis medianis in cellulis juvenilibus, dispersis in cellulis vetustioribus; chloroplasti multi per cellulam et discoidei; procarpia per paginam laminae fertilis dispersa, ex ramulo carpogoniali atque catervis duabus (1–2-cellulis) cellularum sterilium constantia, sine cellula tegenti; cystocarpium ex cellula fusionali amplitudinis moderatae constans, ex quo systema ramosum ferens carposporangia pro parte maxima terminalia; tetrasporangia ex cellulis et centralibus et corticalibus genita.

Thalli consist of blades growing by means of obliquely dividing initials along the margins and intercalary divisions. Macroscopic nerves and microscopic veins are usually present. Cells are multinucleate with a medial arrangement of nuclei in meristematic cells and a parietal arrangement in mature cells. Chloroplasts are many per cell and are discoid or platelike. Female plants bear procarps in a scattered arrangement. Procarps consist of a carpogonial branch and a pair of 1–2-celled sterile-cell groups. There is no procarp cover cell. The cystocarp consists of a moderate-sized fusion cell, from which a branched system bears mostly terminal carposporangia. Tetrasporangia are produced from both central and cortical cells.

In addition to *Cryptopleura*, this tribe includes *Acrosorium* Zanardini ex Kützinger, *Botryoglossum* Kützinger, *Gonimophyllum* Batters, and *Hymenena* Greville.

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